SUITABILITY OF SIX SPECIES OF COMMELINACEAE
AS LARVAL HOSTS OF MOURALIA TINCTORIDES
(LEPIDOPTERA: NOCTUIDAE, PLUSIINAE)

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ABSTRACT

Survival rates to pupal and adult stages, development rates, and pupal weights were determined for larvae of Mouralia tinctorides (Guenée) placed on six species of Commelinaceae. Larvae developed successfully on the dayflower, Commelina diffusa Burmeister, on two wandering jew species, Tradescantia zebrina G. G. Dosse and Tradescantia fluminensis Velloso, and on the spiderwort, Tradescantia ohiensis Rafineque. Poor survival and lower pupal weights occurred with larvae placed on foliage of purple queen Tradescantia pallida (Rose) D. Hunt and on Callisia repens L. Larvae of M. tinctorides did not survive on two artificial diets used as rearing media for many pest Lepidoptera or on foliage of cotton, Gossypium hirsutum L.

Key Words: Insecta, host plant, spiderwort, rearing, looper, Mouralia, Tradescantia.
Resumen

Se determinaron las tasas de supervivencia de las etapas pupales y imaginales, tasas de desarrollo, y pesos pupales para larvas de *Mouralia tintoides* (Guénée) colocadas sobre seis especies de Commelinaeae. Las larvas se lograron de desarrollar con éxito sobre canutillo, *Commelina diffusa* Burmeister, y sobre *Tradescantia zebrina* G. C. Bosse y *T. fluminensis* Velloso y sobre *T. ohiensis* Raffinesque. Supervivencia deficiente y peso pupal más bajo ocurrió en las larvas colocadas sobre follaje de *T. pallida* (Rose) D. Hunt y sobre canutillo rastero, *Callisia repens* L. Las larvas de *M. tintoides* no sobrevivieron ni sobre dos dietas artificiales usadas como medios de criar para muchos lepidópteros plagas, ni sobre el follaje de algodón, *Gossypium hirsutum* L.

*Mouralia tintoides* (Guénée) is a noctuid moth (subfamily Plusiinae) and is related to several important pest insects, most notably in the United States, the cabbage looper, *Trichoplusia ni* (Hübner), and the soybean looper, *Pseudoplusia includens* (Walckcr). It has not been reported as a plant pest and is not known to occur on cultivated crop plants. It is widely distributed in the Neotropics, and in the United States it occurs in Florida, Texas and California (Eichlin & Cunningham 1978).

As part of a comparative study of sex pheromone chemistry of moths in this subfamily, we attempted to rear larvae of *M. tintoides* in the laboratory to provide suitable numbers of insects for experimental purposes. Initially, attempts were made to use published rearing methods based on a pinto bean diet that is widely used for a number of pest species of Noctuidae (Shorey & Hale 1965, Guy et al. 1985). Because we were unsuccessful in rearing *M. tintoides* larvae on these artificial media, subsequent rearing was accomplished using foliage of host plant species.

The only published records of host plants for *M. tintoides* are two species in the Commelinaeae. These are *Tradescantia fluminensis* Velloso (Comstock 1938, Crumb 1966, Eichlin & Cunningham 1978), and *Tradescantia zebrina* G. G. Bosse (=Zebrina pendula* of Eichlin & Cunningham 1978). Comstock (1938) found eggs and larvae on *T. fluminensis* plants and documented complete development of *M. tintoides* on the foliage.

This paper reports the results of comparative assessments of different species of Commelinaeae as larval hosts of *M. tintoides* and reports the rearing of multiple generations of this moth in the laboratory on host plants.

**Materials and Methods**

A colony of *M. tintoides* was started with eggs obtained from mated females collected in a walk-in UV light trap in Gainesville, Florida. Moths collected were placed in a 18 × 13 × 10 cm clear plastic box with foliage of wandering jew, *T. zebrina*. Larvae were maintained on foliage in large plastic storage boxes (45 × 30 × 20 cm) with screened lids. A 50:50 mixture of ground corn cob and pine shavings was placed in the bottom of the boxes to absorb excess moisture from chewed plant foliage and to serve as a pupation medium. Fresh foliage of *T. fluminensis* and *T. zebrina* were supplied as needed until larvae pupated. Larvae and foliage were transferred to new boxes when frass covered the pine shavings and corn cob. Pupating larvae made cocoons of loose shavings and leaves. Pupae were placed in a large screened cage (60 × 60 × 60 cm) containing a potted plant (about 30 cm diam) of *T. zebrina* for mating and oviposition by emerging moths. Females laid eggs on plant foliage which were then transferred with a small paint brush either for experiments or for continued rearing. During this study, 5 generations of *M. tintoides* were reared in the laboratory from eggs initially obtained
from mated females collected in the light trap. Rearing and experiments were conducted in a room with fluorescent lighting on a 12:12 (L:D) light cycle, at 23°C, and 50 ± 5% RH.

Rearing Attempts Using Synthetic Diet

Two attempts were made to rear larvae on synthetic diets. First, 20 first instar larvae were placed in each of five 250 ml waxed carton cups containing 100 grams of a pinto bean based diet used for the cabbage looper (Guy et al. 1985). In a second attempt, 20 first-instar larvae were placed individually in 40 ml clear plastic cups, each containing 10 ml of a commercial diet used for species of Heliothis (Heliothis premix, by Stonewall Industries Inc., Bryan, Texas, U.S.A.). In both cases, larvae were checked daily to assess survival and development.

Comparison of Plant Species as Hosts for *M. tinctoides* Larvae

Six species of Commelinaceae and cotton, *Gossypium hirsutum* L. were evaluated for their suitability as hosts. Plants of *T. zebrina* were obtained commercially, from local nurseries. Patches of *T. fluminensis* and the dayflower *Commelina diffusa* Burmeister were found growing wild in Gainesville and were collected as needed. Both are apparently introduced species that have become established in this area (Clewell 1985). The spiderwort, *Tradescantia ochiensis* Raffinesque, is native to Florida and is abundant in sunny disturbed areas. It also was collected as needed. *Tradescantia pallida* (Rose) D. Hunt was initially found in an outside ornamental planting in Gainesville and was cultivated for this study in soil on the floor of a greenhouse. Patches of *Callisia repens* L. of unknown origin were found inside and outside of a greenhouse at the USDA, ARS, Insect Attractants Laboratory, Gainesville, Florida. Cotton (variety Germaine 510) was grown from seed in pots of sterilized potting soil in a glass greenhouse. Cotton plants used were about 40 cm tall and had not set floral buds.

First-instar larvae of *M. tinctoides* were placed in one liter plastic cannisters with cut foliage of a plant species. Ten larvae were placed in each cannister and were monitored daily until adult emergence. Foliage was added as required, and about 2 cm of a mixture of ground corn cob and pine shavings was kept in the bottom of cannisters to absorb excess moisture and to serve as a pupation medium. Larvae were transferred to new cannisters when the pine shavings became soaked or mold appeared. Four such cannisters were set up for each Commelinaceae plant species and three cannisters were set up with cotton foliage. Records were kept of survival rates, as well as pupation and emergence dates. Pupae were sexed and weighed.

Data comparing development times and pupal weights for *M. tinctoides* on different plant species were subjected to analysis of variance (ANOVA), following procedures for a completely randomized design, and Duncan’s Multiple Range Test to determine significant differences among means (Steel and Torrie 1960). Pupal weights for males and females were compared using Student’s t-test. Voucher specimens of *M. tinctoides* were placed in the Florida State Collection of Arthropods and in the collection of the author.

**RESULTS**

Of the plants tested for suitability as larval hosts, highest survival rates to the adult stage were obtained with *C. diffusa* (at 72.5%), and low survival rates occurred with *T. pallida* (7.5%) and *C. repens* (12.5%) (Table 1). Rates of survival to the adult stage for *M. tinctoides* reared on *T. fluminensis, T. ochiensis,* and *T. zebrina* were similar (52.5 to 55%). Rates for survival to pupation were similar to those for adult emergence...
TABLE 1. MEANS (± STANDARD ERROR) FOR DEVELOPMENT TIMES IN DAYS FROM EGG HATCH TO ADULT Emergence, PERCENTAGES OF INDIVIDUALS SURVIVING FROM EGG HATCH TO ADULT, AND MEAN PUPAL Weights FOR M. tinctoides REARED ON 6 SPECIES OF COMMELINACEAE AND COTTON.

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Development Time (d)</th>
<th>% Survival Pupa</th>
<th>Adult</th>
<th>Pupal Weight (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. fluminensis</td>
<td>33.6 ± 0.3a</td>
<td>60.0%</td>
<td>52.5%</td>
<td>428.4 ± 18.2bc</td>
</tr>
<tr>
<td>T. okiensis</td>
<td>33.7 ± 0.3a</td>
<td>55.0%</td>
<td>55.0%</td>
<td>464.8 ± 12.2c</td>
</tr>
<tr>
<td>T. pallida</td>
<td>36.0 ± 1.5c</td>
<td>17.5%</td>
<td>7.5%</td>
<td>345.1 ± 49.6a</td>
</tr>
<tr>
<td>T. zebrina</td>
<td>36.1 ± 0.6c</td>
<td>55.0%</td>
<td>52.5%</td>
<td>426.9 ± 12.7bc</td>
</tr>
<tr>
<td>C. diffusa</td>
<td>35.5 ± 0.3bc</td>
<td>77.5%</td>
<td>72.5%</td>
<td>412.5 ± 13.5b</td>
</tr>
<tr>
<td>C. repens</td>
<td>34.8 ± 0.3b</td>
<td>27.5%</td>
<td>12.5%</td>
<td>308.1 ± 39.4a</td>
</tr>
<tr>
<td>G. hirsutum</td>
<td>—</td>
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<td>—</td>
</tr>
</tbody>
</table>

Means in a column followed by the same letter are not significantly different by Duncan's (1955) Multiple Range Test at p ≤ 0.05.

for the four plant species yielding the highest Mouraria survival rates (Table 1), showing little pupal mortality.

There were significant differences among development times of larvae on different plant species, as indicated by the ANOVA results (F=7.0, p<0.0001). Mean development time from larval hatching to adult emergence ranged from 33.6 days for larvae on T. fluminensis to 36.0 days for larvae on T. pallida (Table 1). There were also significant differences among pupal weights for M. tinctoides on different plants as indicated by ANOVA (F=6.2, p=0.0005). Highest mean pupal weights were for larvae reared on T. okiensis (464.8 mg) and T. fluminensis (428.4 mg), with lowest pupal weights for C. repens (308.1 mg) and T. pallida (345.1 mg) (Table 1). No larvae survived longer than two days on cotton foliage.

For pupae obtained from the colony of M. tinctoides maintained on T. fluminensis and T. zebrina, mean weights of male pupae (n=111) were significantly greater than mean weights of female pupae (n=105) (436.2 ± 7.5 for males, 403.7 ± 7.7 for females, t=3.03, p=0.02, df=214). The sex ratio (determined for pupae) for larvae reared on the four suitable species of Commelinaceae was near 1 to 1 (51:49, female:male, n=96).

No larvae of M. tinctoides placed on either the pinto bean diet or the Heliothis premix diet survived past the first instar. All died without apparent feeding on the diet.

DISCUSSION

Previous host plant records for M. tinctoides are limited to reports of two species of Commelinaceae: the wandering jew species T. zebrina (Zea brina pendula) and T. fluminensis (Comstock 1938, Eichlin & Cunningham 1978, Crumb 1956). The findings reported here substantiate that these are good hosts for M. tinctoides. Both supported rapid development and high rates of survival to the adult stage. This study also documents the equal suitability of two additional species of Commelinaceae as larval hosts; T. okiensis and C. diffusa. The remaining plant species evaluated, T. pallida and C. repens, were poor hosts for M. tinctoides, as evidenced by poor larval survival and reduced pupal weights. However, some larvae were able to complete development on these two host species. First-instar larvae placed on cotton foliage apparently did not feed.

There is little information on what plant species M. tinctoides utilizes as hosts in nature. Comstock (1988) found M. tinctoides on foliage of T. zebrina and demonstrated complete development from egg to adult on this plant. Also, six M. tinctoides larvae
collected on escaped plants of T. zebrina in Fresno, California were reared to maturity by the author. There are no records of collections of larvae on the other four species of Commelinaceae evaluated. No larvae were found on wild host plants in this study, although the moth appears to be widely distributed in the state of Florida and can be found throughout the year (although infrequently) in Gainesville.

Problems in continuous maintenance of a colony of M. tinctorious included failure of larvae to consume artificial diet, poor oviposition (and presumably mating) in the laboratory, and high mortality of mature larvae. Adequate oviposition was obtained by placing adult moths in cages with potted host plants, on which all eggs were laid. It was considered that host plant kairomones may be involved in mating behavior and in the stimulation of oviposition. A high mortality of mature larvae may have been due to a lack of suitable material to use for the formation of pupation cells and cocoons, and to excess moisture from chewed foliage. This was alleviated largely by adding the mixture of ground corn cob and pine shavings to boxes housing larvae and plant foliage.

These results and findings together provide information needed to rear significant numbers of M. tinctorious in the laboratory and add information on the suitability of several species of Commelinaceae as host plants of this noctuid.

ACKNOWLEDGMENTS

The technical assistance of K. Davis-Hernandez is gratefully acknowledged. Initial attempts to rear M. tinctorious on diet were made by P. Ponce. C. E. Curtis (USDA, ARS, Fresno, CA) collected M. tinctorious larvae on T. zebrina in Fresno, CA. Nancy Coile, Florida State Department of Agriculture, Division of Plant Industry, Gainesville, Florida, kindly provided determinations on plants used. This work was supported in part by the Cooperative State Research Service, USDA, Agreement No. 90-37250-5356.

REFERENCES CITED