**Georgia Satyr Rearing Study Plan of Work**

This study will investigate rearing techniques and host plant preference for Georgia Satyr (*Neonympha areolata*) larvae. The Georgia Satyr is a fairly common butterfly found throughout the southeastern US and is closely related to the endangered Saint Francis Satyr (*Neonympha mitchellii francisci*) (Glassberg, 1999). *N. m. francisci* has a very limited distribution, restricted to locations the training grounds of Fort Bragg, NC. Previous studies have investigated population dynamics and behavior of *N. areolata* and *N. m. francisci* through studying adult members of the species, however, little is known about the larvae of these species and their development. Despite efforts by Hall and Haddad no *N. m. francisci* larvae have been observed in the wild (Hall and Haddad 2005). No *N. areolata* larvae have been observed in the wild either (Floridata, 2006). However in *N. m. francisci* oviposition has been observed. Hall et al. (2001) found that females laid eggs on several different species of plants many of which, such as cane, seem very unlikely host plants for the larvae. Therefore it is believed that the larvae move from where they hatch and select the plant hosts themselves, which makes it impossible to tell what the host plants are through oviposition (Hall and Haddad 2005).

For my study I will use *N. areolata* larvae because they are not endangered, however, hopefully the techniques and information gained from this study can be applied to learn more about the larvae of *N. m. francisci*. Such information could be valuable to the conservation of this endangered butterfly.
While no *N. areolata* larvae have been observed in the wild there is speculation about which plants might be the primary host plants for the larvae. This is based on plant distribution in the butterfly sites as well as the host plants of related butterflies. For my study I chose six of these possible host plants. Five are sedges in the genus *Carex* (*C. atlantica, C. debilis, C. lurida, C. mitchelliana, and C. stricta*) and the sixth is a grass in the genus *Calamovilfa*. Four of the sedges being used I grew last summer for a different project. The final sedge and grass species will be collected from various sites where they grow on Fort Bragg.

There will be two parts to this study. The first part investigates how well the larvae can grow and survive given one of the six possible host plants (survival study). The second part explores what the larva’s preference of plant is given the choice between two possible host plants (choice study). I expect that survival rate will differ between the six possible host plants in the survival study and that the plants showing the highest survival rate will be the plants the larvae show a preference for in the choice study.

I will obtain eggs for the study by collecting gravid females from butterfly population sites on Fort Brag. The primary collection sites for *N. areolata* will be Twig Rush Bog and the NEA Savanna. Females will be housed in oviposition chambers for 2 to 3 days while they lay eggs. The females will then be released.

The oviposition chambers will be made from plastic flowerpots. The plastic flowerpots will be covered in screen and placed into another pot with water in it. Grasses, sedges or some other type of vegetation for the butterfly to perch on will be inserted through holes in the bottom of the flowerpot with their stems extending into the water in the pot below. The oviposition chambers will be housed in ambient conditions at field house near Fort Brag. They will be placed on a covered porch to protect them from rain and sun. They will be checked multiple times a day to monitor the female’s health. Once the females are released the eggs will be collected from the
flowerpots. They will be placed into plastic Tupperware containers with cheese cloth secured over them. Clippings from one of the possible host plants will be placed in the containers with eggs so that when the larvae hatch they will immediately have something to feed on. The clippings will be changed out at least once a day.

Once the eggs have hatched the larvae will be place on the six possible host plants mentioned earlier. The plants will be growing in plastic one gallon flower pots. Using potted plants as apposed to clippings of sedge or grass leaves will hopefully eliminate any degradation in plant quality that could affect larval growth. For the survival study there will be one species of possible host plant in each pot. For the choice study there will be two species of possible host plants in each pot. There will be one pot for every combination of two of the six possible host plants. The plants will be trimmed down so that they are a reasonable size for locating larvae on them. Also they will we trimmed so that they all have approximately the same amount of vegetation.

The larvae will be transferred directly on the leaves of the possible host plants. Four to six larvae will be placed in each pot. In the choice study pots two or three larvae will be placed on each plant. After the larvae have been placed, half of a tomato cage will be inserting into each pot. Cheese Cloth will be used as screening to cover the plants. The cheese cloth will go over the tomato cage and be secured around the edge of the pots with wire. In addition duct tape will be used to seal off the edge of the cheese cloth against the side of the pots. This will insure that no insects or other predators enter the pots.

The pots will be housed in ambient conditions at a field house near Fort Bragg. The screening will be removed and the larvae checked every other day for the first week to week and a half. The larvae will be checked less frequently as they mature and their chances of survival
increase. For the survival study checking the larvae will entail locating all the larvae that were originally place on the plant or spending 10 minutes searching for them. The number or larvae observed will be recorded as well as their position on the plant. When measuring the larvae’s position on the sedge we will look at what section of the leaf it is on, bottom, middle, or top third. We will also record whether the larvae are on the dorsal or ventral surface of the blade. We will also measure the height they are from the soil in the pot. We will measure the length of the larvae to the nearest half-millimeter, using a ruler. Along with these measurements we will record general observations about the larvae, their behavior and the conditions of the sedges. For the choice study we will simply record the number of larvae observed on each of the two possible host plants. As with the survival study observers will located all larvae place on the plant or spend 10 min searching.

We will continue to regularly observe the larvae through pupation. Any adult *N. areolata* that emerge will be released back to the site where the eggs were collected from. *N. areolata* are bivoltine thus there will be two flight periods to collect eggs and perform this experiment.

The objectives of this study are to develop effective methods for rearing *N. areolata* larvae and to gain insight into how they grow and develop. To see if larvae feeding on a range of several possible host plants exhibit significantly different growth and/or survival rates. To see which plant the larvae prefer to feed on and also to look at where the larvae spend the majority of their time. Ultimately the goal is to try to develop a greater understanding of how larvae would act in their natural environment.

Learning more about the behaviors and preferences of *N. areolata* larvae will hopefully aid in finding and observing larvae in the wild. Evaluating how larvae grow in their natural habitat can give insights into habitat preferences and limitations. Also the methods used in this study can be used with
the endangered Saint Francis Satyr. The results of a study with the Saint Francis Satyr could be important in creating and implementing conservation techniques.

Sources


