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and
Cooperators

Gypsy Moth Research Review Progress Reports

1984 Field Season

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2.1.1.1

Gypsy Moth Program
Progress Report
December 20, 1985

Title: Quantifying habitat-differentiated gypsy moth population dynamics at low densities

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Coop. No.: 23-973
Start 4/15/85
End: 4/15/86
RWU: 2201
Cooperating Scientist: William E. Wallner

Objective(s):

1. Develop techniques for quantifying refugia contribution of habitat due to bark crevices and rock, and evaluate their importance in gypsy moth larval, pupal and egg mass distribution, and their role in competing with burlap bands as aggregation sites. This study will be carried out at NY, only.

2. Evaluate the impact of local augmentation of egg mass density due to bands by comparing density trends on plots with and without bands (NY only) and with egg masses removed from bands (CT only).

3. Add the following baseline data for all sites: understory vegetation (including bare ground and rock); canopy density following defoliation; edaphic variables (slope, aspect, elevation, parent rock).

4. Commence detailed multivariate analyses relating insect distribution, abundance and survivorship to habitat characteristics.

5. Continue to quantify distribution, abundance and survivorship of larval, pupal and egg mass stages. Continue to evaluate the effectiveness of sampling techniques, develop estimation models and test their validity and make appropriate adjustments to the sampling regime.

Accomplishments/Plans:

1. At 4 NE sites, coverage of rock and woody debris was estimated for each plot using a percentage cover scale. A classification of rock texture, fracturing and overhanging ledges was incorporated into this method and the end result was a semi-quantitative description of natural refugia available to gypsy moth. These data will be used in an ordination of egg mass, larval and pupal density data with structural features of the habitat.

   Plans: Questions such as "are changes in suvivorship of one or more life stages correlated with the relative abundance of refugia" can now be addressed. Since the sampling scheme was expanded to include all sites, additional time is required to analyze data in 1986-87.

2. To quantify the sampling bias due to use of burlap banding, plots without burlap banded trees were maintained at NY (n=35). Through the efforts of VT cooperators, the same arrangement of unbanded plots dispersed between banded plots was established (n=24). In 1984, a 14-fold increase in egg mass density was seen in NY on banded plots compared to unbanded plots. By contrast, a 2-fold decrease in egg mass density was seen in 1985 on banded plots as compared to unbanded plots. Using NY as an example and looking at density changes over two generations, there was a net 9-fold decrease on banded plots and a 3-fold increase on unbanded plots from 1984 to 1985. Fourth and fifth larval instar densities at NY were sufficiently high to make us think that we had induced an outbreak by using burlap bands. However, a dramatic decrease in survivorship was seen in both NY and VT which corresponded to high densities of a predator, the white-footed deer mouse (*Peromyscus leucopus*) as reported by Dr. Harvey Smith at the cooperator's meeting in Stowe, VT in September 1985. To date we can say that the initial effects of banding is a temporary increase in densities associated with bands, but the effects of banding on survivorship are yet unclear without data for at least one additional generation.

   Plans: Continuation of larval, pupal and egg mass density data collection in the same manner as in the two previous years.

3. Understory vegetation cover in addition to percentage of exposed plot area were estimated on all plots with burlap-banded trees. These data will be used to look at distribution and abundance of larvae, pupae and egg masses, and combined with the quantitative overstory vegetation data and structural features at the plot

level, will contribute to the classification of habitat susceptibility to the gypsy moth. Additional descriptive data were taken from maps (slope, elevation, aspect). There was no significant defoliation, so canopy photography was omitted for this year, with the exception of a second year of baseline data collected at NY and VT. Plans: Provided there is defoliation on one or more of the sites in the upcoming year, we intend to quantify damage using canopy photography. At present, no additional habitat data is required until we have completed multivariate analyses (see Objective #4).

4. Analysis of variance (ANOVA) has been used to date to examine the contribution of habitat variables in accounting for the variation in gypsy moth density and distribution. Based on larval density data at NY, ridgetop densities were comparatively higher than on mesic plots in 1984. Conversely, 1985 larval densities were greater on the low elevation mesic plots as compared to the ridgetop plots. The 1984 larval density data conforms to the concept that ridgetop "focal areas" may exist as population reservoirs. However, data from 1985 do not support this hypothesis. Density data for another generation are crucial to examining patterns and trends in gypsy moth density. A multivariate treatment of these data is the next logical step in addressing questions regarding the existence of 'foci' and habitat susceptibility.

   Plans: Continue analysis of the data using a multivariate approach.

5. Data on the distribution, abundance and survivorship of larval, pupal and egg mass life stages were collected consistently at 4 NE sites. The sampling design was adjusted for sampling at higher pupal and egg mass densities at two sites (CT, MA). Life stage and habitat data are now being summarized for distribution to cooperating scientists. The data base is collected, organized and managed in a manner that allows us to provide cooperators with information at a wide range of levels to assist them with the analysis and interpretation of their data. The gypsy moth population and associated habitat data is a powerful tool for those doing concurrent research on the same sites. For example, Dr. Bruce Parker and Margaret Skinner of the University of Vermont will be using summaries of life stage and habitat data which were collected collaboratively, to aid in the analysis of their parasite data at Bryant Mt., VT. Forest Service scientist Dr. Tom ODell has expressed an interest in looking at egg parasitism in relation to oviposition site. These and other collaborations are possible due to the strength and consistency of the data base.

Two models for quantifying fecundity and hatch from gypsy moth egg masses have been completed and validated. One publication has been submitted and another is in preparation on the two models. These methods are being used to look at the relative contributions of fecundity and egg survivorship (hatch) to generational density changes. The most salient result to date emerged from looking at fecundity changes in low density populations. The data suggest that fecundity changes can make the principal contribution to overall density changes (as much as 60%). This is the first evidence that fecundity may be an important factor in triggering density increases and potentially, outbreaks. Data for additional generations is required to further explore this issue. Collaboration with European workers on the role of fecundity changes in gypsy moth population dynamics is being arranged. Dr. Pietro Luciano of the Istituto di Entomologia agraria dell'Universita di Sassari has responded to a request to compare gypsy moth fecundity in Sardinia, Italy with North American populations using the models we have developed.

Plans: Continue to quantify the distribution, abundance and survivorship of larval, pupal and egg mass stages; maintain the multivariate data base and supply cooperators with relevant data upon request; continue the development of life tables and predictive models; continue to evaluate the efficacy of sampling methods appropriate for low density populations.

Final Product(s): In cooperation with other research studies -

1. Provide evidence to support or refute the existence of focal areas, their role in gypsy moth outbreaks, and the potential for manipulating habitat structure and insect outbreaks.

2. Provide a quantitative basis for classifying habitat susceptibility to gypsy moth, in order to develop and improve existing risk rating techniques.

3. Evaluate the efficacy of sampling and estimation techniques for gypsy moth life stages at low densities, with emphasis on larval, pupal and egg mass sampling with burlap bands, comparison of fixed-area and variable-radius plot sampling, and reconstruction of population histories using egg mass data.

4. Provide, as produced, equations for use in the gypsy moth life stage model.

5. Provide a multivariate data base for use by other researchers in aiding the interpretation of their data and testing models.

Publications:

Moore, K. B. and Jones, C.G. 1986. Field estimation of fecundity in gypsy moth, _Lymantria dispar_ L. Environ. Entomol. (submitted).

Moore, K.B. and Jones, C.G. 1986. Estimation of field hatch from egg masses of the gypsy moth, _Lymantria dispar_ L. Environ. Entomol. (in preparation).

Presentations:

Jones, C.G. and Moore, K.B. 1985. Gypsy moth research at the Institute of Ecosystem Studies. Northeast Forest Pest Council Conference, Portland, ME (invited presentation).

Moore, K.B. and Jones, C.G. 1985. Fecundity and hatch in low density gypsy moth populations. Entomological Society of America Annual Meeting, Hollywood, FL.

Cooperators:

Dr. William Wallner, USDA, Forest Service, Hamden, CT.
Dr. Bruce Parker, University of Vermont, Burlington, VT.
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