N O T E

A Survey of Parasitoids and Other Organisms Affecting Gypsy Moth (Lepidoptera: *Lymantriia dispar* L.) along the Leading Edge of Its Southward Movement[1]

F. L. Hastings,[2,3] F. P. Hain[2] and T. M. Odell[4]

Department of Entomology, College of Agriculture and Life Sciences, North Carolina State University, Box 7626, Raleigh, NC 27695 USA and USDA Forest Service, 51 Mill Pond Rd., Hamden, CT 06514 USA

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We recently evaluated the effect of small mammal predation on freeze-dried gypsy moth, *Lymantria dispar* L., pupae in the coastal plain, piedmont and mountains along the leading edge of the gypsy moth's southward migration (Hastings et al., unpubl.). Although small mammals are the principal consumers of gypsy moth pupae, we noted significant predation by invertebrates in 10 of 24 sampling periods during this 4-yr study. We identified parasitoids associated with gypsy moth and measured gypsy moth mortality by disease organisms as it moved into southern forests.

In 1993 and 1994, approximately 7,000 F_1-sterile gypsy moth egg masses were distributed at the base of trees within two 1-ha plots in three geographical locations in Virginia. These egg masses are the progeny of irradiated males and untreated females [Mastro and Schwalbe, 1987. Proceedings series (International Atomic Energy Agency) Report No. STP/PUB/763, pp. 15-40]. Plots were near Nassawadox, Northampton Co. (Coastal Plain), in Lake Anna State Park, Spotsylvania Co. (Piedmont) and in the George Washington National Forest, Amherst Co. (Mountain). The developmental stages of the gypsy moth 2-3, 4-5, and 6-pupa were collected, placed on fresh foliage within coolers, and transported to the laboratory. These were held individually on artificial diet (Odell et al. 1985. Pp. 355-367. *In* P. Singh and R. F. Moore [eds.], Handbook of insect rearing. Elsevier, NY) in the laboratory for determination of parasitoids.

During 1994, we surveyed the same plots for *Entomophaga maimaiga* Humber, Shimazu & Soper and added another ha F_1-sterile egg release plot in Camden Co., NC, where gypsy moth was recently established. We also surveyed a gypsy moth population in Orange Co., VA, about 6.4 kms from Lake Anna State Park. Dead larvae

[1]Received 04 October 2000; accepted for publication 23 September 2001.
[2]N.C. State University.
[3]To whom all inquiries should be addressed (email: felton_hastings@ncsu.edu).
[4]USDA Forest Service.

suspended on the boles of trees were evaluated as follows: Using sterile technique, individual dead insects were macerated in 2 ml sterile water, and the slurry was pipetted onto 2 glass microscope slides. One slide was examined by light microscopy at 400× to determine the presence of *E. maimaiga* resting spores, and the second slide was stained with a mixture of methylene azure and eosin (giemsa), rinsed, dried and examined at 1000× for viral polyhedral inclusion bodies. Identification was by John Podgwaite, USDA Forest Service Laboratory, Hamden, CT and Ann Hajek, Department of Entomology, Cornell University, Ithaca, NY.

A preliminary summary of the parasitoids from larvae/pupae that developed from the F_1-eggs is provided (Table 1). It is notable that we found a number of parasites at Lake Anna, an area that currently does not have gypsy moths. Also, the abundance of *Eusisyropa virilis* (Aldrich & Webber) in the coastal sites is of interest for two reasons: it is rarely found in gypsy moth in New England and has a host range of 30 species in 14 families of Lepidoptera. *Blepharipa pratensis* (Meigen) is conspicuous by its relative absence, except in the upper slopes of the mountain plots. The small larval parasitoids *Compsilura concinnata* (Meigen), *Cotesia melanoscela* (Ratzberg), *Phobocampe disparis* (Viereck), and *Hyposoter tricoloripes* (Viereck) were also not abundant, although *C. melanoscela* was relatively abundant in the mountains. The differences in parasitoids reared from year to year suggest long-term studies are

Table 1. Preliminary identification of parasitoids recovered in gypsy moth F_1-sterile trap-host plots in Virginia

	Coastal plain		Piedmont		Mountain	
	1993	1994	1993	1994	1993	1994
Diptera (*Tachinidae*)						
Compsilura concinnata (Meigen)	5	0	2	0	8	0
Parasetigena silvestris (Robineau-Desvoidy)	7	0	3	0	122	2
Blepharipa pratensis (Meigen)	1	0	0	0	40	0
Lespesia aletiae (Riley)	1	0	2	0	0	0
Eusisypropa virilis (Aldrich & Webber)	29	0	0	0	6	0
Tachinid sp.	0	0	1	0	0	0
Hymenoptera (*Braconidae*)						
Cotesia melanoscela (Ratzeberg)	4	31	17	23	133	173
Hymenoptera (*Ichneumonidae*)						
Coccygomimus disparis (Viereck)	0	0	0	0	4	0
Phobocampe disparis (Viereck)	1	0	1	7	3	15
Theronia atalantae atalantae (Poda)	2	0	0	0	14	9
Hyposoter sp.	0	0	1	0	5	4

Approximately 7000 F_1-sterile gypsy moth egg masses were distributed around trees in each of six 1-ha plots. Gypsy moth were collected at instars, 2-3, 4-5, and 6-pupa and held in individual cups of artificial diet for determination of parasitoids. In 1993 we collected 3929 gypsy moth and in 1994 we collected 2157. Collections were during the first and third weeks of May and June and the first week of July.

Table 2. Survey for *Entomophaga maimaiga* (Zygomycetes: Entomophthoralea) in gypsy moth F_1-sterile trap-host plots in Virginia

Location	Gypsy moths collected	Mortality*	Diagnosis**
Camden Co. NC	447	165	3 *E. maimaiga*†
			11 NPV
			152 other
Northampton Co. VA	676	249	67 *E. maimaiga*‡,‡‡
			40 NPV
			146 other
Lake Anna, Spotsylvania Co. VA	458	111	0 *E. maimaiga*
			1 NPV
			110 other
Orange Co. VA (near Lake Anna)	169	22	0 *E. maimaiga*
			7 NPV
			15 other
GWNF Amherst Co. VA	407	71	4 *E. maimaiga*‡‡
			1 NPV
			66 other

Dead larvae suspended from tree boles in plots where sterile gypsy moth egg masses were placed were examined under 400× for *E. maimaiga* and 1000× for viral polyhedral inclusion bodies during 1994.

* All larvae and pupae that died and were not parasitized were examined.

** *E. maimaiga* (*Entomophaga maimaiga*), NPV (gypsy moth nucleopolyhedrosis virus)

† One also having NPV

‡ Four also having NPV.

‡‡ Mortality reported (Hajek et al. 1996. Environ. Entomol. 25: 709-721).

necessary to establish which beneficials are most prevalent as the gypsy moth moves into more moderate climates. The survey for the presence of *E. maimaiga* indicated the fungus was within our plots in the Coastal Plain and Mountains. We did not find it within the Piedmont of Virginia at Lake Anna in Spotsylvania Co., which is not infested nor in nearby Orange Co. which is infested. We demonstrated the feasibility of using sterile egg masses to survey for *E. maimaiga (Table 2).*