RATES OF PARASITISM AND SEX RATIOS OF *ABLERUS CLISIOCAMPAE*[1] AND *OOENCYRTUS CLISIOCAMPAE*[2] EGG PARASITES OF THE FOREST TENT CATERPILLAR, *MALACOSOMA DISSTRIA*[3] IN SOUTHERN LOUISIANA

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ABSTRACT

Populations of egg parasites, *Ablerus clisiocampae* Ashmead and *Ooencyrtus clisiocampae* Ashmead, of the forest tent caterpillar, *Malacosoma disstria* Hbn., were found to be 73% and 55% females, respectively. These parasities emerged a mean of 31 days after the beginning of forest tent caterpillar eclosion under controlled laboratory conditions. Percent parasitism was highest in the upper tree crowns, in 1980 - 81 averaging 33.6%, and was highest at the middle crown levels in 1981 - 82, averaging 20.3%.

Key Words: Egg parasites, forest tent caterpillar, sex ratios.

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INTRODUCTION

Ablerus clisiocampae Ashmead and *Ooencyrtus clisiocampae* Ashmead were first reported as egg parasites of the forest tent caterpillar (FTC), *Malacosoma disstria* Hbn., by Hodson (1939). However, their biology is still not completely understood. Both species of parasites overwinter in Minnesota as larvae, and adults emerge approximately 30 days after egg hatch of the host. This timing assures their presence at the time when the next generation of FTC egg masses are laid (Hodson 1941).

These two species of egg parasities were encountered while investigating the population dynamics of the FTC in Ascension and Assumption Parishes in Louisiana. Reported herein are our findings of the rates of parasitism at three tree crown levels and the sex ratios of emerging adults in southern Louisiana.

METHODS AND MATERIALS

Egg masses of the FTC were collected in the field from the time of oviposition in late May and early June 1980, through the time of eclosion in early to mid-March, 1982. A minimum of nine water tupelo trees *(Nyssa aquatica* L.) were felled each year in three plots in Ascension and Assumption Parishes in southern Louisiana to obtain forest tent caterpillar egg masses. This number was necessary

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to provide a sample with plus or minus 20% error. Each plot was approximately 2 ha in size. Nine trees from each plot were visually partitioned into the upper, mid and lower crown levels. Where more than nine trees were felled, the data from these were used in addition to the nine trees felled at each plot to calculate the data in Table 2. The number of eggs/ha were calculated by use of a stand table and the mean number of egg masses found on the sample trees. Forest tent caterpillar eggs (June - October collections) were kept in a controlled environment of 16h L:8h D at 27C and 75% RH. Sex ratios and the dates of parasite emergence were recorded as adults emerged. A subsample of the forest tent caterpillar egg masses collected in the winter (November - February) were held in cold storage at 5C until normal field eclosion time (March). Then they were removed from cold storage and put into the controlled environment described earlier. One end of each twig containing an egg mass was immersed in water after removal from cold storage. We noted that twig swelling as a result of water uptake accelerated the forest tent caterpillar rate of eclosion. The egg masses (winter collections) were held in the controlled environment for 45 days to collect emerging *A. clisiocampae* and *O. clisiocampae* adults. Approximately 20% of each egg mass was examined using the technique of Witter and Kulman (1972) to determine the rate of parasitism. *Ablerus clisiocampae* and *O. clisiocampe* were distinguished from each other using gross physical characteristics. *Ablerus clisiocampae* had red compound eyes and *O. clisiocampae* had a metallic green thorax. The presence of an ovipositor was easily distinguished in both species. This character was used to separate males and females.

RESULTS AND DISCUSSION

Adult *A. clisiocampae* and *O. clisiocampae* were found to emerge from parasitized eggs 31 ± 4.8 ($\bar{x}$ ± S.E.) days after the beginning of the FTC (host) eclosion in the laboratory. The upper crown had the largest number of parasitized eggs in 1981, but the mid-crown level had the highest percent parasitism in 1982 (Table 1). Numbers of FTC eggs appear to be highest in the upper crown, second highest in the mid-crown and least in the lower crown (Table 1).

Ablerus clisiocampae had parasitism rates ranging from 3.9 to 35.6% of the total egg count. *Ooencyrtus clisiocampae* parasitism ranged from 2.8 to 25.2% (Table 2). The lowest rates of parasitism for both *A. clisiocampae* and *O. clisiocampae* were found in 1981 at Plot 1. This plot had a very high egg population that year (Table 2). In 1982, percent parasitism increased to 14.6% for *A. clisiocampae* and 10.4% for *O. clisiocampae.* Even though a percent increase occurred in 1982, total numbers of parasities per ha declined. The percent parasitism increase occurred concurrently with a FTC population decrease to 1,252 ± 595 eggs per ha (Table 2). Similar results were noted at Plot 3. Percent parasitism decreased in 1982 concurrent with a FTC population increase of 4 ×. The numbers of parasities per ha for Plot 3 in 1982, remained almost static. A small increase or decrease could have occurred since the error terms for the egg mass estimates for those years overlap. Parasitism (%) increased at Plot 2 from 1981 to 1982 for both parasite species. The increase in real numbers of parasites per ha was 3.3 × the previous years population. Concurrently, the FTC population at Plot 2 increased by a factor of 3.5. This FTC population change was of less magnitude than that found for the other two plots. Also, the amount of change in percent parasitism was not as great

Table 1. Mean number of forest tent caterpillar eggs/mass, viability (%), and mortality (%) by *A. clisiocampae* and *O. clisiocampae* for three crown levels and three study sites (combined) in Louisiana, 1981 and 1982.

Year/ Category	Upper crown Mean ± S.E. Eggs/Mass	%	Mid-crown Mean ± S.E. Eggs/Mass	%	Lower crown Mean ± S.E. Eggs/Mass	%
1981	n = 44		n = 15		n = 11	
Total eggs	345.8 ± 16.81		280.7 ± 15.66		348.0 ± 17.52	
Viable	214.7 ± 31.52	62.1	214.3 ± 24.16	76.3	283.8 ± 36.44	81.6
Parasitized	116.3 ± 37.11	33.6	38.4 ± 23.63	13.7	52.4 ± 36.79	15.1
1982	n = 59		n = 20		n = 10	
Total eggs	353.4 ± 10.67		394.2 ± 30.39		392.3 ± 51.00	
Viable	288.2 ± 11.55	81.6	298.6 ± 37.15	75.6	310.9 ± 55.87	79.3
Parasitized	56.0 ± 4.77	15.8	80.2 ± 16.61	20.5	69.9 ± 21.84	17.8

Table 2. Rates of parasitism and sex ratios (male:female) of *A. clisiocampae* and *O. clisiocampae* from forest tent caterpillar egg masses in Louisiana, 1981 - 1982.

							A. clisiocampae		*O. clisiocampae*	
Plot	Year	No. of egg masses examined	$\bar{x}$ No. eggs/ mass	$\bar{x}$ No. egg masses/ha	*A. clisiocampae* % paras.	*O. clisiocampae* % paras.	Sex ratios (male: female)	% Females	Sex ratios (Male: female)	% Females
1	1981	66	338.3	13,620 ± 301	3.9	2.8	1:2.7	72.7	1:1.3	75.0
	1982	38	378.8	1,252 ± 595	14.6	10.4	1:3.0	75.0	1:1.6	61.5
2	1981	15	397.9	1,739 ± 488	7.6	9.3	1:2.6	72.2	1:1.7	61.9
	1982	57	316.0	6,237 ± 2,346	14.2	10.1	1:1.9	65.3	1:0.8	45.3
3	1981	5	335.9	3,291 ± 1,653	35.6	25.2	1:4.3	81.2	1:0.5	33.3
	1982	111	397.2	13,312 ± 8,322	6.8	4.8	1:2.4	70.7	1:1.1	53.2

as that found in Plots 1 and 3. Statistical analysis of parasite numbers indicated no appreciable correlation with host numbers, but Plot 1 and Plot 2 seemed to exhibit some response by the parasite to changes in the FTC populations.

Sex ratios for *A. clisiocampae* ranged from 1:1.9 (male:female) at Plot 2 in 1981 to 1:4.3 at Plot 3 in 1980 (Table 2). *Ooencyrtus clisiocampae* sex ratios ranged from 1:0.8 at Plot 2 in 1981 to 1:1.7 at Plot 2 in 1980. Emerging *A. clisiocampae* and *O. clisiocampae* averaged 73.0 and 55.0% adult females, respectively, when the tree study sites and the two years were combined.

The percent of *A. clisiocampae* females increased in Plot 1 (declining host population) and decreased in Plots 2 and 3 (increasing host popluations) for 1981 and 1982. This indicates that percentages of females increased with a declining population. Theoretically, this would insure a more effective searching pattern for female parasites when the host population is low. *Ooencyrtus clisiocampae* showed no trend with regard to percentages of females found. Plot 1 had declining percentages of female parasites (declining host population), Plot 2 had declining percentages of female parasites (increasing host population) and Plot 3 had an increasing percentage of female parasites (increasing host population) for 1981 and 1982.

Hodson (1939) found both species of parasites to be univoltine in Minnesota. However, they emerged in Louisiana periodically from July through November from masses allowed to remain at ambient (24 - 27C) laboratory temperatures. Whether adults emerging in summer and fall previous to host eclosion were able to locate additional hosts, or overwintered as adults is unknown. Hodson (1939) found that diapause for these species was easily broken without cold temperatures. This might partially explain the laboratory emergence during June through November. The majority of both species overwintered in Louisiana within FTC egg masses and emerged after FTC eclosion, as stated earlier.

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LITERATURE CITED

Hodson, A. C. 1939. Biological notes on the egg parasites of *Malacosoma disstria* Hbn. Ann. Entomol. Soc. Am. 32: 131-6.

Hodson, A. C. 1941. A ecological study of the forest tent caterpillar *Malacosoma disstria* Hbn., in northern Minnesota. Univ. of Minnesota Stn. Tech. Bull. No. 148. 55 pp.

Witter, J. A., and H. M. Kulman. 1972. Mortality factors affecting eggs of the forest tent caterpillar *Malacosoma disstria* (Lepidoptera: Lasiocampidae). Can. Entomol. 104: 705-10.