STUDIES ON THE *CATOCALA* (NOCTUIDAE) OF SOUTHERN NEW ENGLAND II. COMPARISON OF COLLECTING PROCEDURES

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Adult nocturnal Lepidoptera are collected by several very different methods. Brower (1947) has described some of the more common methods—baits (unless indicated otherwise, "baits" in this paper refer to some kind of sugar mixture) and lights during the night, and hunting resting moths during the day. Each of these collecting methods has been modified so that numerous light traps, bait mixtures, etc. are used. Recently parabolic moth sheets (McFarland, 1966) and collapsible bait traps (Platt, 1969) have been added to the list of collecting methods from which lepidopterists can choose. With growing interest and knowledge in insect pheromones, many entomologists are now using traps baited with virgin females or synthetic sex pheromones (e.g. Saario, Shorey & Gaston, 1970). Considered together with differences in time of collecting and differences in ecological placement of the trap, collecting procedures are widely divergent.

How do these various collecting procedures compare when sampling the same area? Hamilton and Steiner (1939) and Robinson and Robinson (1950) have previously compared various trapping methods as to effectiveness of capture. The former, interested in controlling the Codling Moth (*Carpocapsa pomonella* (Linnaeus)), a noctuid pest of orchards, compared bait and light traps and found that light traps captured more moths per trap, but that the percentage of females was much smaller than in the bait traps. The Robinsons have compared various light sources and suggest that the spectral content of the light is not important within limits, although the power and surface brightness of the source does affect trap efficiency. Others report that the kind of light (mercury, tungsten, etc.) determines not only the species attracted, but also the sex (Edwards, 1962).

The importance of a trap's location in sampling populations has also been noted. Hamilton and Steiner (1939) found that traps located at the margin (border rows) of an orchard averaged more than twice the number of moths per trap than those located in the interior. Holbrook, Beroza and Burgess (1960) reported differences in effectiveness of pheromone-baited traps (Gypsy Moth—*Porthetria dispar* (Linnaeus)) with terrain and local growth. Williams (1939) reported that an elevated light trap (35 feet above the ground) collected not only a greater number of species and individuals, but also a larger percentage of females than a trap located at ground level. This effect was stronger in some species than in others. Saario et al. (1970) confirmed differences in capture of one species (*Trichoplusia ni* (Hübner)) with pheromone-baited traps at different heights from the ground.

The time of collecting also appears to be an important factor. Williams (1935, 1939), Hamilton and Steiner (1939), Hutchins (1940), and Graham et al. (1964) have demonstrated differences in activity peaks related to time of night. These studies also suggest that activity patterns may be a function of temperature, humidity, wind, cloud cover, etc. However, Saario et al. (1970) could not find correlations relating daily capture variations (one species at pheromone trap) with nightly variations in temperature, relative humidity, or full moonlight. But Shorey (1966) has noted a greater range in copulation timing under naturally fluctuating outdoor conditions, and points out that some of these variables (e.g. humidity) are difficult to assess in nature because of great variation within microenvironments. Edwards (1962) and Saario et al. (1970) have shown that the time of median capture relative to sunset may vary with moth age and the season.

The present study represents an attempt to compare collecting procedures used in sampling members of a single genus (*Catocala*). Direct comparisons of collecting procedures at a single location (but not always the same season) are made by means of rank correlations of species. Rank correlations of species collected at different localities, using both similar and different collecting procedures are also listed, although they may be less meaningful than those obtained simultaneously at one location.

Studies on *Catocala* are generally limited to the turn of the century (Bailey, 1877; Bunker, 1874; French, 1880; Johnson, 1880, 1882; Rowley, 1908, 1909; Rowley and Berry, 1909–1914), but recently some comparisons within the genus have been made when different sampling methods were involved (Sargent and Hessel, 1970). Hopefully the data in this report may aid in interpreting prior comparisons, as well as comparisons which might be made in the future.

METHODS

A total of approximately 11,750 records of individual adult *Catocala* were obtained from four localities in southern New England: (1) West Hatfield, Mass. (1622 records, 1969–70, CGK); (2) Pelham, Mass. (544

TABLE 1. Summary of collecting procedures and data.

Area	Year	Method[a]	Time Season	Time Night[b]	No. Indiv.	No. Species
West Hatfield	1970	RT (W)	7/13–8/26	Dusk–Dawn	273	24
		RT (F)[c]	8/23–9/26	Dusk–Dawn	692	26
		Bait	7/13–9/26	< 2400 hrs.	198	19
	1969	Bait	7/20–9/26	< 2400 hrs.	459	21
Leverett	1970	RT	7/28–10/16	> 2300 hrs.	1161	31
		UV	July–Oct.	< 2300 hrs.	169	23
		Spots	July–Oct.	< 2300 hrs.	91	23
		Bait	July–Sept.	< 2300 hrs.	85	8
	1969	UV	July–Aug.	< 2300 hrs.	41	18
		Spots	July–Aug.	< 2300 hrs.	36	10
		Bait	July–Aug.	< 2300 hrs.	188	13
	1968	Spots	July–Sept.	< 2300 hrs.	30	9
		Bait	July–Sept.	< 2300 hrs.	309	15
	1967	Spots & Bait	July–Sept.	< 2300 hrs.	311	21
Pelham	1966	Bait	July–Sept.	< 2300 hrs.	294	21
	1965	Bait	July–Sept.	< 2300 hrs.	195	20
	1964	Bait	July–Sept.	< 2300 hrs.	55	16
Washington	1970	RT	Entire[d]	Dusk–Dawn	886	30
	1969	RT	Entire	Dusk–Dawn	579	28
	1968	RT	Entire	Dusk–Dawn	424	29
	1967	RT	Entire	Dusk–Dawn	1151	35
	1965	RT	Entire	Dusk–Dawn	553	32
	1964	RT	Entire	Dusk–Dawn	530	30
	1963	RT	Entire	Dusk–Dawn	306	31
	1962	RT	Entire	Dusk–Dawn	1412	29
	1961	RT	Entire	Dusk–Dawn	1275	33

[a] RT—Robinson Trap; W—woods; F—field.
[b] <—before; >—after. Times are approximate as given and constitute the majority of the records.
[c] Woods and field sites totaled had 965 individuals of 31 different species.
[d] Trap was operated both before and after seasons of *Catocala* flight.

records, 1964–66, TDS); (3) Leverett, Mass. (2471 records, 1967–70, TDS); (4) Washington, Conn. (7116 records, 1960–70, Sidney A. Hessel). Brief descriptions of these localities, and comments regarding collecting procedures in each, follow. A summary of collecting procedures and data is in Table 1.

(1) WEST HATFIELD, MASS.

Description: The West Hatfield (Hampshire County) site lies 2.2 miles west of the Connecticut River and 5 miles north of Northampton. Farm, woods, and swampland lie between the site and the Connecticut River. To the west are the foothills of the Berkshires. Collecting was done in mixed deciduous woodlands in an area locally referred to as "The Rocks." At the collecting site there is a 140 foot rise in elevation within 800 feet (U.S. Geological Survey Maps).

Collecting procedures: Collecting was done at bait (a brown sugar-cooking winegrape juice mixture painted on 20 trees along a trail at "The Rocks") in 1969 and 1970 on a daily basis from approximately 15 July to 20 September. Only nights of heavy rain, and about a half dozen single day absences, were missed for the two years. The mixture was usually applied fresh every night about a half hour before dusk, and trees were checked regularly every half hour until about midnight. On nights of much *Catocala* activity, the trail was checked more frequently and until 0200 hours, at which time there usually appeared to be a lapse in feeding by the moths. Occasional collecting after midnight rarely added any individual records on nights of poor *Catocala* activity. Daily records were kept on the species, sex, and time of activity.

In 1970 collecting was done at one Robinson mercury vapor light trap. The trap was turned on at dusk and left running until shortly after dawn at which time the contents were examined, and the species and sex of each individual *Catocala* recorded. The trap was operated every night, regardless of weather or absence. Attempts were made early in the season to check contents at intervals during the night, but the activity of the trapped moths made this unfeasible.

From 13 July to 22 August, the trap was located in the woods about 30 yards from the wood's edge atop a rock ledge. The trap could be seen for some distance within the woods, although view was restricted in some directions due to neighboring rock ledges. The trap was in view of nearly every tree on the sugar trail. From 22 August to 21 September the trap was located in a new situation about 250 yards to the northeast. Here the trap was in an open field about 50 yards from the edge of the main woods. A row of pine trees was immediately behind the trap. From 23–26 August a second Robinson Trap was borrowed and traps were run at both locations simultaneously.

(2) LEVERETT, MASS.

Description: The Leverett (Franklin County) location is 4 miles east of the Connecticut River and 7.5 miles northeast of the collecting site at West Hatfield (USGS Maps). Collecting was done on a level area at the top of a hill. At the fringe of the Pelham Hills, this area consists primarily of mixed deciduous woodland similar to that at West Hatfield. There is also some vegetation typical of earlier seral stages of old field succession within the area.

Collecting procedures: *Catocala* were taken from 1967–70 at bait (brown sugar-beer mixture), at several 150-watt Westinghouse outdoor spotlights, and at rest. The data for sugar and lights were not separated in 1967. One 15 watt black light fluorescent tube was added in 1969 and 1970, and one Robinson mercury vapor light trap was added in 1970 (beginning 28 July). Collecting was done on a daily basis from 1 July to 1 September with only occasional 1–2 day absences. All collecting procedures (except bait) were continued until mid-October in 1970.

The Robinson Trap was located in a small open area only 10 yards from the edge of the woods. It was shaded through approximately 90 compass degrees by a house, but was visible from all trees on the sugar trail. Records for the trap were kept every night except for five days in late August when the trap was being used in West Hatfield. The trap was running only from 2300 hours to dawn until 10 September when it was left running from dusk to dawn for the remainder of the season (also running all night on 28–29 August when CGK kept the records for the Leverett location). The bait trail was checked and the other light sources were usually kept running until 2300 hours. Sex and time of activity data were kept beginning in 1968.

(3) PELHAM, MASS.

Description: The Pelham (Hampshire County) site, which is 2.5 miles east of Amherst, is 4.2 miles south-southeast of the Leverett site, and 8.5 miles east of the West Hatfield site (USGS Maps). Collecting was done in an acre of woods in a residential area. The soil is sandy and vegetation is that found in a pitch pine (*Pinus rigida* Mill.) community. Ornamental trees and shrubs, including various Rosaceae and honey locust (*Gleditsia triacanthos* L.) are common.

Collecting procedures: Collecting was done during the summers of 1964–66 and was limited to bait. Individuals were not routinely sexed, and times of capture were not noted.

(4) WASHINGTON, CONN.

Description: This collecting area (Litchfield County) has been described in Sargent and Hessel (1970). The mixed deciduous woodlands here have more Juglandaceae representatives, particularly butternut (*Juglans cinerea* L.), than localities in the Amherst area 65 miles to the Northeast.

Collecting procedures: Records of *Catocala* here were predominantly taken at one Robinson mercury vapor light trap with a few records taken at one 15 watt black light fluorescent tube. The lights were in operation all night from mid-March to mid-November of each year, with continuous records provided from 1961–70 (except 1966). Data on sex were not routinely kept.

The *Catocala* were identified as keyed and described in Forbes (1954) and foodplants were also taken from that source. Certain similar species (*C. gracilis* Edwards, *C. sordida* Grote; *C. crataegi* Saunders, *C. mira* Grote, *C. blandula* Hulst) were not always identified as to species. *C. gracilis* and *C. sordida* were distinguished by TDS and CGK in 1970 and *C. crataegi*, *C. blandula* and *C. mira* by CGK in 1969–70 (collected specimens only), TDS in 1970 and S. A. Hessel since 1961.

The rank correlation of species was found using the Spearman test (Siegel, 1956) with the correction factor for tied ranks being used in every case. The Spearman coefficient was also used to find the probability under a Student's t distribution that correlations between ranks were due to chance. In cases where certain species were not distinguished in one of the samples being compared, a single rank was given to the total number of individuals of these species in both samples.

RESULTS AND DISCUSSION

Comparison of Collecting Procedures

The rank correlations of species collected at a single location by different procedures, as well as by similar procedures in different years, are listed in Table 2. Whenever possible, correlations (of different procedures) are from comparisons of samples taken during the same season. The correlations are grouped according to location—West Hatfield, Leverett, and Washington—and are arranged within each group in decreasing order of similarity of species ranks.

The following observations derived from data in Table 2 seem most interesting. At both Leverett and West Hatfield, there were higher degrees of similarity between samples taken at bait in two consecutive

TABLE 2. Rank correlations of species across different procedures (or seasons) at a single locality.

Area	Procedures (or Seasons) Compared A	B	N	r_s	P_{r_s}	t	P_t
W. Hatfield Bait	1969	1970	23	.653	$<.01$	3.92	$<.0005$
W. Hatfield 1970	RT	Bait	32	.469	$<.01$	2.91	$<.005$
Leverett 1969–70	Spots	UV	27	.841	$<.01$	7.77	$<.0005$
Leverett	UV, Spots 1968–70	RT 1970	29	.778	$<.01$	6.46	$<.0005$
Leverett Bait	1969	1970	14	.557	$<.05$	2.28	$<.025$
Leverett 1968–70	UV, Spots	Bait	28	.337	$>.05$	1.83	$<.05$
Leverett	RT 1970	Bait 1968–70	29	.238	$>.05$	1.29	$>.10$
Leverett 1970	Light (total)	Bait	30	.193	$>.05$	1.04	$>.10$
Washington RT	1965	1969	33	.831	$<.01$	8.31	$<.0005$
Washington RT	1963	1967	36	.712	$<.01$	5.91	$<.0005$

N—Number of different species for combined procedures.
r_s—Spearman Rank Correlation Coefficient.
P_{r_s}—Probability associated with Spearman Coefficient.
t—Student's t value.
P_t—Probability associated with Student's t value.

years than there were between bait and lights within a single year. The correlation was statistically significant for West Hatfield but only marginally so for Leverett. At Leverett the highest correlation occurred between samples taken at spot lights and a UV light summed over two years, with samples taken at UV and spots combined also showing a high correlation with the Robinson Trap. This is not surprising if the spectral composition of a light source is not important (Robinson and Robinson, 1950).

The higher degree of similarity between spots and UV, if significant, may be explained by the simultaneous operation of these light sources, while the Robinson Trap was sampling activity during a different time of the night. The higher degree of similarity between UV and spots combined and bait, than between the Robinson Trap and bait may be similarly explained.

TABLE 3. Rank correlations of species across different localities using similar and different collecting procedures.

Procedure	Area A	Area B	N	r_s	P_{r_s}	t	P_t
Lights 1970	WH	L	31	.843	$<.01$	8.32	$<.0005$
RT—1970	WH	L	31	.811	$<.01$	7.46	$<.0005$
Totals 1970	WH	L	33	.793	$<.01$	7.25	$<.0005$
Lights 7/13–8/22 1970	WH (woods)	L	25	.851	$<.01$	7.77	$<.0005$
Lights 8/27–9/21 1970	WH (field)	L	29	.669	$<.01$	4.68	$<.0005$
Bait 1968–70	WH	L	25	.495	$<.01$	2.73	$<.01$
Bait	P 1964–66	L 1968–70	26	.715	$<.01$	5.01	$<.0005$
Bait	WH 1969–70	P 1964–66	30	.262	$>.05$	1.44	$<.10$
RT	WH 1970	W 1967	35	.549	$<.01$	3.80	$<.0005$
1970	WH & L	W	35	.492	$<.01$	3.25	$<.005$
RT—1970	WH	W	33	.501	$<.01$	3.23	$<.005$
Lights 1970	L	W	34	.444	$<.01$	2.80	$<.005$
RT—1970	L	W	32	.435	$<.01$	2.65	$<.01$
Totals to 1969	WH & L	W	36	.349		2.17	$<.025$
1970	WH & L No RT	W	37	.231		1.40	$<.10$

Symbols same as in Table 2.
Localities are designated as follows: Leverett (L), Pelham (P), West Hatfield (WH) and Washington (W).

It is equally interesting that a very high degree of correlation occurred between two separated years of sampling by a Robinson Trap at a single location (Washington), even when there was nearly a fourfold difference in total moths taken (e.g. 1967 vs. 1963).

Comparison of Localities

Table 3 lists rank correlations of *Catocala* species collected at different localities, using both similar and different collecting procedures. The interpretation of these correlations may be somewhat equivocal. When comparing across localities (and seasons), presence or absence of correlation might be due to either similarities or differences in 1) collecting procedures, or 2) the populations being sampled.

Samples taken at light sources at West Hatfield and Leverett during the same year appear to be statistically identical. This is not surprising since the vegetation is quite similar at the two locations. However this identity is barely maintained when comparing the populations taken at bait from the same two locations.

The populations sampled by light at Washington and both localities in the Amherst area during the same year have a high degree of similarity, although less than that between West Hatfield and Leverett. The decrease in similarity is not surprising, considering the greater abundance of Juglandaceae species as well as the singular presence of bayberry (*Myrica pensylvanica* Loisel) at Washington. However, the similarity existing in populations is not as evident when different collecting procedures have been used over different years (combined data before 1970 which is presented by Sargent and Hessel, 1970, as well as 1970 analysis of combined Amherst areas without Robinson Trap vs. Washington).

Pelham and West Hatfield both seem to be better baiting areas than Leverett (number of species as well as number of individuals) although the high degree of similarity at bait occurs between Pelham and Leverett, with Pelham and West Hatfield having a correlation which is not even statistically significant. This can apparently be explained by a disparity between moths within the major foodplant groups which are active at bait in these localities—Salicaceae and Juglandaceae feeders predominating at West Hatfield, and Rosaceae and Ericaceae feeders predominating at Pelham, and to a great extent at Leverett as well. Since species within these foodplant groups are relatively similar in abundance at light in West Hatfield and Leverett, this further suggests that collecting at bait and light measures different kinds of activity.

It is impossible to determine which collecting procedures give a better representation of the population present in a locality without actually knowing what this population is, independent of the collecting procedures. Since all collecting procedures appear to miss species which appear to be reasonably common in a given locality (e.g., *C. cara* Guenée and *C. amatrix* (Hübner) at light and several Juglandaceae feeders at bait), a combination of collecting procedures would seem to be the best choice when sampling *Catocala* populations. Generally speaking, light trap samples seem to be more consistent from year to year and yield larger samples (both in terms of species and individuals) than other procedures.

Location of Robinson Trap

The location of the light trap appears to be an important consideration if the researcher is interested in assessing the number of moths in a given area. Data to support this contention were obtained when the trap operated in West Hatfield was moved from a woods to a field site in the middle of the 1970 season. The trap operated at Leverett was kept at the same location for the entire season and thus served as the control in this experiment. Since the effective range of the mercury vapor lamp trap is reputed to be about 100 yards (Robinson and Robinson, 1950), the normal movement of adult *Catocala* to be greater than 200 yards (Brower, 1930), and the vegetation of the woodlands to be roughly homogeneous across both West Hatfield trap sites, one can assume that the populations being sampled at the two West Hatfield trap sites were virtually identical.

From Table 3 it can be seen that samples from both West Hatfield sites shared a close correlation with the Leverett trap, a fact which was not surprising considering the wooded location of the control area. However, more surprising was the difference in numbers captured at the two locations. Because *Catocala* are active in the woods, one might intuitively expect that a trap located there would collect more moths than the same trap located in a field 50 yards from the wood's edge. However, Fig. 1, which graphically depicts the average number of species and individuals captured per day over five-day intervals during the 1970 season, reveals that the trap located in the field was much more effective than the same trap located in the woods.

Because the control trap was operating continuously and simultaneously with the experimental trap and showed no major seasonal differences in moth activity, it dramatically reinforces the conclusion that seasonal differences are not important factors in the increased effectiveness at the field site. The four-day interval when traps were operated at both wood and field sites lends further support. It is interesting that the field and control traps show nearly identical curves for activity of species and individuals. The greater effectiveness of the field trap over the control in the mid-portion of the season can be explained both by the greater abundance of a single species (*C. ilia* (Cramer)) at the West Hatfield location, and a difference in collecting procedures (field trap was operated all night whereas the control trap was operated only after 2300 hours). The near identity of activity in the field and control traps during the latter portion

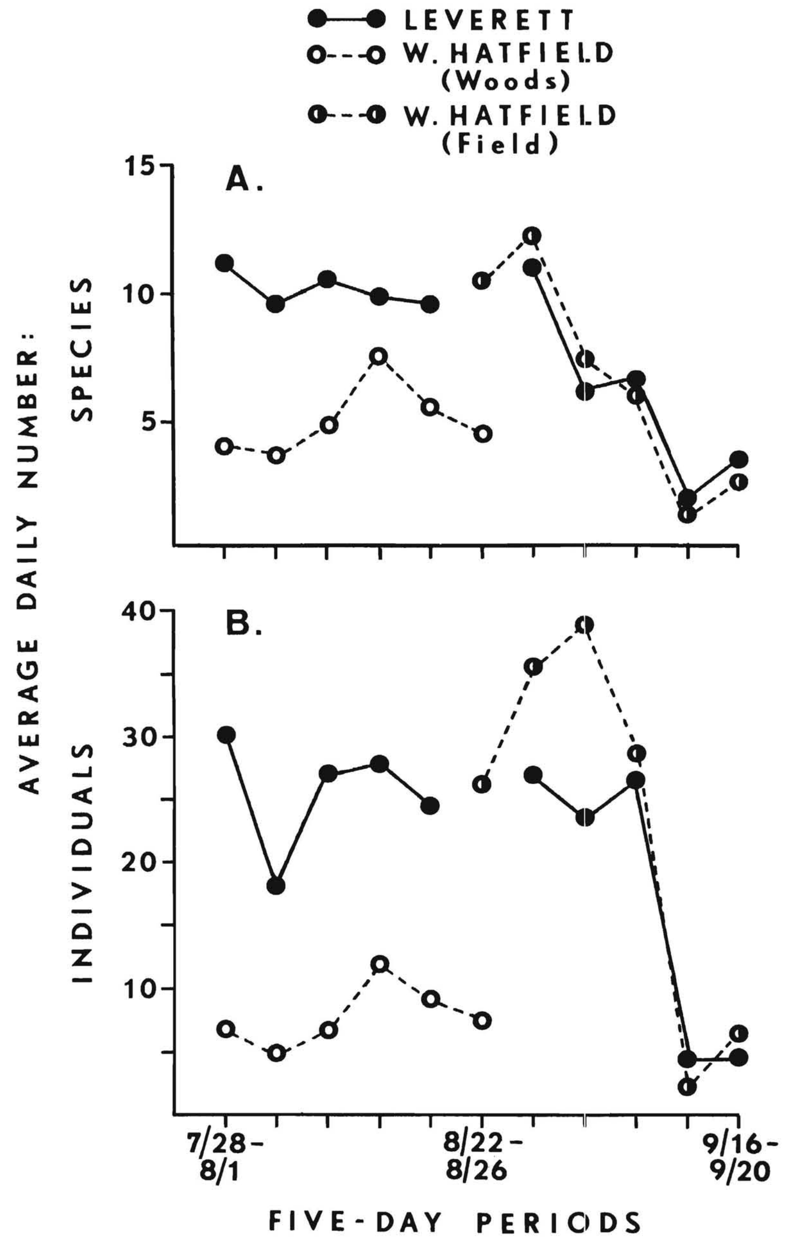

Fig. 1. Average daily capture of *Catocala* species (A) and individuals (B) in a Robinson Trap over successive 5-day periods at three locations in 1970.

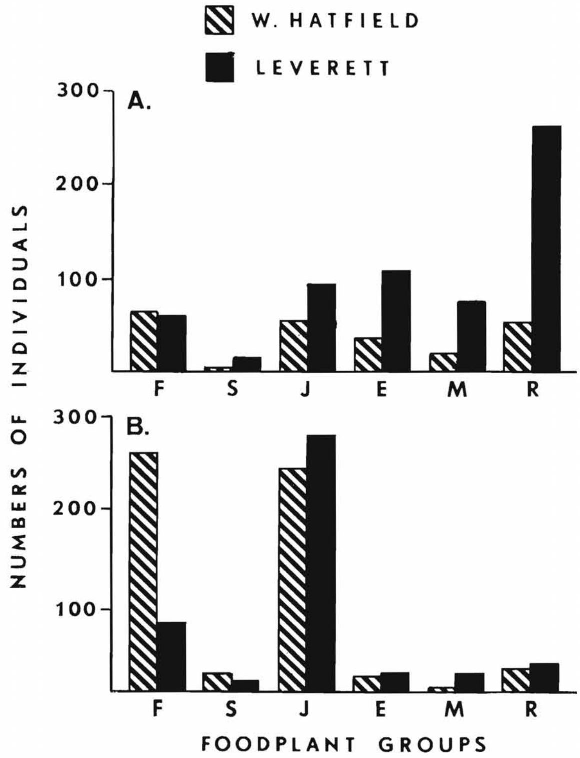

Fig. 2. Numbers of individuals of each *Catocala* foodplant group captured in Robinson Traps in West Hatfield (A, woods, 13 July–26 August; B, field, 22 August–21 September) and Leverett (A, 28 July–26 August; B, 22 August–21 September) in 1970. Foodplant groups are: Fagaceae (F), Salicaceae (S), Juglandaceae (J), Ericaceae (E), Myricaceae (M), and Rosaceae (R).

of the season also corresponds to the period when both traps were operated all night.

Examination of Fig. 2 points out that the increased effectiveness of the field over the woods site relative to the control is true for all foodplant groups with the exception of the Myricaceae. Also of the twenty species which were active both before and after the experimental trap was moved, 80% (i.e., all but four) had an increase in numbers relative to the control when the trap was relocated in the field.

One naturally wonders why the trap located in the field was more effective than the same one located in the woods. The answer may be found with reference to the work of Robinson and Robinson (1950). They concluded that a light source is not an attractant to moths; rather activity at light merely reflects activity of moths within the "inner dazzle sphere" of

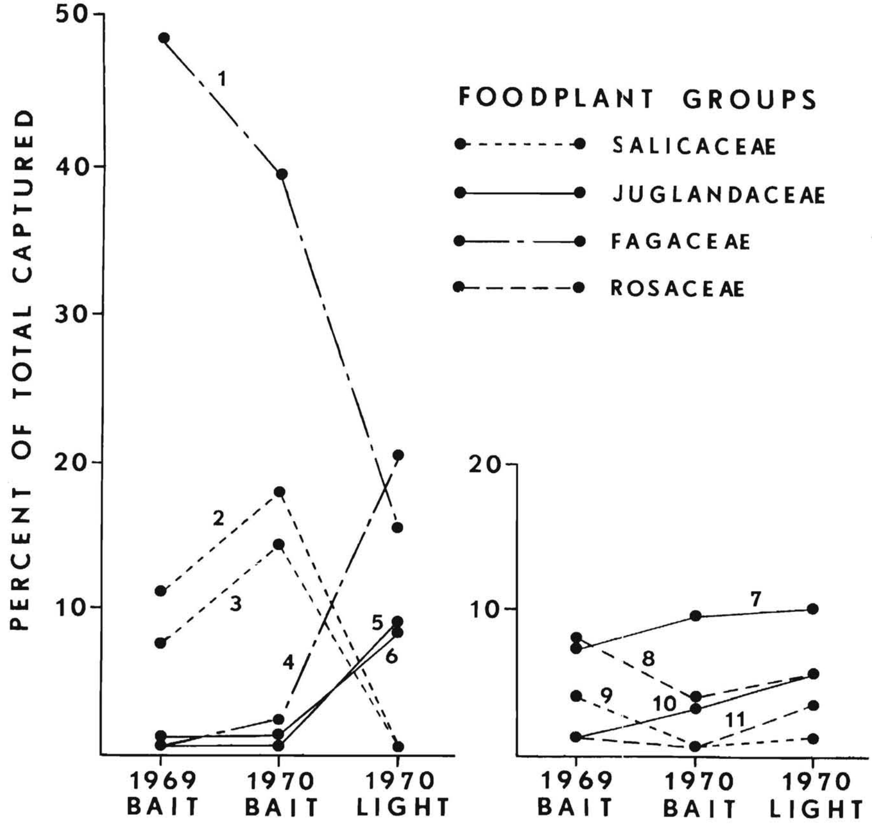

Fig. 3. Percentages of total individuals of some "common" *Catocala* species captured at bait and a Robinson Trap in West Hatfield in 1969 and 1970. Species fluctuating greatly with collecting procedures (to the left) include: 1) *ilia*, 2) *cara*, 3) *amatrix*, 4) *amica*, 5) *habilis*, and 6) *palaeogama*. Species relatively constant across collecting procedures (to the right) include: 7) *retecta*, 8) *ultronia*, 9) *concumbens*, 10) *epione*, and 11) *grynea*.

the light source. If this is true, one would suspect that large trees and rock ledges around the trap would form shadow cones within the "dazzle sphere," enabling moths to escape. The shadow areas cast in this zone from the trap located in the field are much smaller and might very well account for the difference in effectiveness. The control trap was located near the wood's edge, and it might be expected that shadows interrupting the "dazzle sphere" of this trap were not as great as those cast by the trap in the woods, and might have been intermediate between those cast by the traps at the field and woods sites. Attractant theories may also provide an answer if one views shadow cones as breaking areas of attraction.

Williams (1939) has commented on the surprising success of a trap in an open and unsheltered location previously thought not to be a particularly good location for insects.

Collecting Procedure Comparison by Species

An examination of the samples taken by various collecting procedures suggested that species feeding on certain foodplants were much more commonly collected by one procedure than another. Further, relative differences in activity at bait and light were not uniform for all species feeding on the same foodplant. These differences are graphically presented in Fig. 3. Data used in this figure are from the records of CGK from West Hatfield.

In general, it appears that very different collecting procedures, e.g., bait and light, are not sampling identically from the same population. Further, there appears to be consistency (in terms of species rank correlations) across seasons in samples taken by the same collecting procedures.

Fig. 3 illustrates the percentage of total *Catocala* collected for several common species within the genus. Generally, percentage differences between two years at bait are minimal for each species, whereas differences in the same year between bait and light are often dramatic. For example, *C. ilia* comprised about 50% of all *Catocala* collected at bait (and greater than 90% of all Fagaceae feeders at bait), but was dominated by another Fagaceae feeder, *C. amica* (Hübner), at light. Similarly *C. cara* comprised nearly 50% of all Salicaceae feeders at bait, yet was uncommonly collected at light. On the other hand, *C. concumbens* Walker, which was relatively uncommon at bait, was the most common Salicaceae feeder in the light trap. Common species within the same foodplant group (defined as all *Catocala* feeding on that foodplant), generally appear to parallel each other in activity at bait and lights (e.g., *C. cara* and *C. amatrix*; *C. paleogama* Guenée and *C. habilis* Grote). Three Ericaceae feeders, *C. gracilis*, *C. sordida* and *C. andromedae* (Guenée), were commonly taken at lights, but only one individual of the three species was taken at sugar for the two years. These results can be essentially replicated with data collected by TDS in Leverett.

SUMMARY

Catocala populations taken by various collecting procedures at four localities in southern New England were compared using species rank correlation coefficients. Highest correlations were obtained when the same procedure was used and when collecting was done during the same time of night. These correlations were greater for light sources than for

baits. A comparison of samples taken in a light trap located at a field and woods site showed a similar degree of correlation to a control, but there was much greater effectiveness of the trap at the field site.

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THREE BUTTERFLY SPECIES (LYCAENIDAE, NYMPHALIDAE, AND HELICONIIDAE) NEW TO TEXAS AND THE UNITED STATES[1]

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The author (1970) gave five species of Rhopalocera new to Texas and the United States which were probably introduced through Hurricane Beulah of 1967. Three more species are now added. Time and additional research would be required to determine the specific ecological factors influencing permanent residence should any of these become established north of the Rio Grande.

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