GENERAL NOTES

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ON THE LOCATION OF SOME H. A. FREEMAN SKIPPER HOLOTYPES (HESPERIIDAE)

Additional key words: American Museum of Natural History, Mexico.

In "Records, New Species, and a new Genus of Hesperiidae from Mexico," Journal of the Lepidopterists' Society, Vol. 23, Supplement 2, 1969, I stated that the holotypes of most of the species described were to be placed in the United States National Museum, Washington, D.C. Actually, these holotypes were deposited in the American Museum of Natural History (AMNH), New York, in 1981 along with my entire collection of Mexican Hesperiidae. Thus, holotypes of the following species can be found in the AMNH: *Pyrrhopyge tzotzili, Mysoria wilsoni, Epargyreus windi, Epargyreus brodkorbi* (designated in 1969 paper for Museum of Zoology, Univ. of Michigan), *Astraptes louiseae, Astraptes gilberti, Polythrix mexicanus, Aethilla chiapa, Mimia chiapaensis, Windia windi, Staphylus veytius, Staphylus zuritus, Quadrus francesius, Enosis matheri, Dalla ramirezi, Vettius argentus, Niconiades comitana, Anthoptus macalpinei, Cynea nigricola, Pheraeus covadonga, Carystoides escalantei, Carystoides abrahami, Carystoides floresi, Carystoides mexicana, Atrytone mazai, Atrytone potosiensis, Mellana montezuma, Euphyes chamuli,* and *Tirynthia huasteca.*

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EFFECTS OF HANDLING ON *EUPHYDRYAS EDITHIA* (NYMPHALIDAE)

Additional key words: Mark-release-recapture, wing wear, aging.

A central component of most studies of insect population dynamics is mark-release-recapture (MRR). It is generally assumed that handling insects during MRR does not affect either their survival or behavior, but rarely have these assumptions been tested. Several previous studies have looked at possible effects of handling on recapture probabilities. R. H. T. Mattoni and M. S. B. Seiger (1963, J. Res. Lepid. 1:237–244) compared observed with expected values of multiple recaptures of *Philotes sonorensis* and found no decrease in observed recaptures, as would be expected if repeated handling had a negative effect on recapture probability. Other studies, however, found reduced probabilities of recapturing handled butterflies in the area of first capture (Singer, M. C. & P. Wedlake 1981, Ecol. Entomol. 6:215–216; Morton, A. C. 1982, Oecologia 53:105–110; Gall, L. F. 1984a, Biol. Conserv. 28:139–154).

Studies attempting to determine the age-structure of butterfly populations commonly use wing-wear as an indicator of age (Watt, W. B., F. S. Chew, L. R. G. Snyder, A. G. Watt & D. E. Rothschild 1977, Oecologia 27:1–22; Ehrlich, P. R., A. E. Launer & D. D. Murphy 1984, Am. Nat. 124:525–539; Gall, L. F. 1984b, Biol. Conserv. 28:111–138). Butterflies captured with undamaged (fresh) wings are considered young, while butterflies with worn wings are scored as old. In such studies, it is important to determine whether the MRR technique itself measurably wears the insects; such an effect would increase age estimates of repeatedly handled butterflies and possibly decrease survival. In this

TABLE 1. Linear regression of change in condition on number of handling events, by days in residence (males).

Days in residence	Sample size	Slope (m)	95% confidence limits for the slope		Correlation coefficient (R)	Power* (1 − β)
3	24	0.08	−0.30	0.47	0.10	0.12
4	30	0.00	−0.29	0.30	0.01	0.13
5	32	−0.18	−0.39	0.04	0.29	0.52
6	28	−0.21	−0.41	0.00	0.37	0.71
7	25	0.12	−0.13	0.37	0.20	0.25
8	27	0.07	−0.11	0.26	0.17	0.27
9	25	−0.03	−0.19	0.13	0.08	0.12
10	19	0.09	−0.10	0.28	0.23	0.21

* Power values for correlation coefficients from Cohen, J. 1977, Statistical power analysis for the behavioral sciences, rev. ed., Academic Press, New York, 474 pp.

study, we attempt to determine if handling during MRR studies causes an increased rate of wing-wear.

At Stanford University's Jasper Ridge Biological Preserve, *Euphydryas editha bayensis* (Sternitzky) populations have been under experimental observation since 1960. In the past twenty-eight years, extensive data from MRR studies have been collected (Ehrlich, P. R. 1965, Evolution 19:327–336; Ehrlich, P. R., R. R. White, M. C. Singer, S. W. McKechnie & L. E. Gilbert 1975, Science 188:221–228; and Baughman, J. F., D. D. Murphy & P. R. Ehrlich 1988, Oecologia 75:593–600).

In 1981, an intensive MRR study was carried out at the Jasper Ridge Area H demographic unit from 23 March to 1 May (Ehrlich et al. 1984, above). Butterflies were handled on all of the days that they flew; a total of 478 individuals were handled at least once during the season (310 males and 168 females). Males are more likely to be caught than females because of differences in flight behavior. Three experienced field workers attempted to capture all of the butterflies present on each day of the flight season. The MRR protocol followed that of P. R. Ehrlich and S. E. Davidson (1960, J. Lepid. Soc. 14: 227–229), with each individual given a characteristic mark with a felt-tipped, permanent-ink pen. Between capture and release, individuals were kept in glassine envelopes with their wings together to keep them from moving; these envelopes were then placed in slotted boxes appropriately marked by sex and area of capture. After collecting was completed, butterflies were removed from the envelopes with forceps, marked (on initial capture), examined, and released.

At capture and at each subsequent recapture, the individual's age, as estimated by wing-wear, was recorded on a scale of 0.5 to 3.5, in increments of 0.5, with 0.5 indicating a newly emerged individual and 3.5 a very worn one (for an alternate technique, see Watt et al., above). In this study, both loss of scales and nicks were used as indicators of wear. When making age estimates, an effort was made to ignore obvious handling damage (such as fingerprints) and to score only naturally induced wear. For consistency, the same three people performed all of the sampling and two checked each rating.

TABLE 2. Linear regression of change in condition on number of handling events by days in residence (females).

Days in residence	Sample size	Slope (m)	95% confidence limits for the slope		Correlation coefficient (R)	Power (1 − β)
3	18	0.22	−0.07	0.52	0.37	0.54
4	20	0.02	−0.21	0.24	0.04	0.11
5	14	0.20	−0.19	0.59	0.30	0.28
6	13	−0.12	−0.54	0.30	0.19	0.16
7	11	0.02	−0.41	0.44	0.03	0.09

Field records indicate how many times each individual was captured, the day each capture or recapture occurred, and the estimated condition at the time of each handling. From these data, the length of time between first and last capture (days in residence), the number of handling events that occurred (initial capture plus total number of recaptures), and how much the butterfly aged (change in condition), were determined for each individual.

To determine if handling the butterflies influenced the rate at which they aged (as indicated by wing-wear), a linear regression of change in condition on number of handling events was performed (Model I linear regression with >1 value of Y for each value of X; for details, see Sokal, R. R. & F. J. Rohlf 1981, Biometry, 2nd ed., W. H. Freeman and Co., New York, 859 pp.). Previous studies (Ehrlich et al. 1984, above) have shown that male and female *Euphydryas* wear at significantly different rates; therefore, the data were pooled by sex. For each sex, individuals were pooled by number of days in residence in order to separate natural wear from wear induced by handling. Individuals captured only once were not included in the analysis. Only males in residence between 3 and 10 days (210 individuals), and females in residence 3 to 7 days (76 individuals), were considered. Too few were in residence for longer and shorter periods to make analysis reliable.

The results of the regressions are summarized in Tables 1 and 2. In all cases, regression line slopes are not significantly different from zero. Although with small sample sizes it is not possible to affirm the null hypothesis at a satisfactory power (only males 6 days in residence had a test power >0.70; for most of the other regressions, the probability of rejecting a false null hypothesis ($1 - \beta$) was <0.30), the results suggest that there is no significant relationship between amount of handling and change in condition. In addition, a linear regression of change in condition on days in residence was performed for each sex, pooling across number of handling events. In both cases, slopes were significantly different from zero (males, $m = 0.12$, $P < 0.001$; females, $m = 0.13$, $P < 0.001$), indicating a significant relationship between time and change in condition, as would be expected. The majority of males (157 of 210) and females (56 of 76) had an initial condition of 0.5 and over half of the remaining individuals in each case had initial conditions of 1.0; consequently, further subdividing the butterflies into wing-wear cohorts (grouping by initial condition) did not change the significance of any of the results.

It is doubtful, however, that handling never causes wear. Different investigators, because of varying amounts of practice or ability, probably cause different amounts of wear to the butterflies they handle. The same person may occasionally cause a great deal of wear to a single butterfly (due to difficulty in disintangling the butterfly from the net, for example) while normally causing very little wear. It is probable that the greatest handling-induced change in condition occurs during the initial capture and marking. Subsequent recaptures may not greatly affect overall condition. Singer and Wedlake (above) found that *Graphium sarpedon* (L.) handled while being marked were much less likely to be recaptured than those not handled while marked, which they interpreted as a change in dispersal behavior due to the initial capture. A marking effect limited to the date of capture was found in *Boloria acrocnema* (Gall & Sperling) by Gall (1984b, above). Capturing and marking the butterflies disrupted their flight activity immediately following release, but this effect did not appear to last beyond the marking date. Wear induced by initial capture and marking would not cause an increased rate of wing-wear, but possibly could affect survival.

The conclusion that increased handling does not significantly change the amount of wear observable on *Euphydryas editha* has two important implications for MRR studies. First, it indicates that handling may not significantly "age" *Euphydryas editha* individuals. Secondly, it suggests that, when done carefully, it is possible to estimate age reliably using wing-wear as an indicator.

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PERFORATED CUPOLA ORGANS ON LARVAE OF EUSELASIINAE (RIODINIDAE)

Additional key words: *Euselasia aurantiaca, E. mystica, Hades noctula,* ultrastructure.

Perforated cupola organs (PCO's) are minute, epidermal secretory organs, homologous to setae, found on larvae of many Lycaenidae (Malicky, H. 1970, J. Lepid. Soc. 24:190–202). They also occur on larvae of Riodinidae. These organs are known to secrete amino acids in some species (Pierce, N. E. 1983, Ph.D. Thesis, Harvard University, Cambridge, Massachusetts, 286 pp., Diss. Abs. Int. 44:1708B), and are thought to be involved in maintenance of ant associations in myrmecophilous species even though they are also found on amyrmecophilous larvae (Malicky, above; Kitching, R. L. & B. Luke 1985, J. Nat. Hist. 19:259–276). These organs have been relatively well-studied in Lycaenidae (DeVries, P. J., D. J. Harvey & I. J. Kitching 1986, J. Nat. Hist. 20:621–633 and included references; Kitching, R. L. 1987, J. Nat. Hist. 21:535–544), but there is little information on their occurrence in Riodinidae (sometimes considered a subfamily of Lycaenidae). They have been illustrated using scanning electron microscopy in one amyrmecophilous species of Old World Hemearinae, *Hamearis lucina* (L.) (Kitching & Luke, above), and one myrmecophilous species of New World Riodininae, *Pandemos palaeste* Hewitson (Harvey, D. J. & L. E. Gilbert, J. Nat. Hist. in press). They have not been illustrated, however, for larvae of a third subfamily, Euselasiinae, although their presence in this group has been alluded to (Harvey, D.J. unpubl., cited *in* DeVries et al., above). Larvae of the remaining subfamilies, the monotypic Styginae and Corrachiinae, are unknown (Harvey, D. J. 1987, pp. 446–447 *in* Stehr, F. (ed.), Immature insects, Vol. 1, Kendall/Hunt, Dubuque, Iowa, 754 pp.).

Euselasiinae consists of three genera: *Euselasia* with over 130 species, *Hades* with 2 species, and the monotypic *Methone* (Harvey, D. J. 1987, Ph.D. Thesis, University of Texas, Austin, Texas, 216 pp., Diss. Abs. Int. 49:625B). Distribution and morphology of PCO's on mature larvae of three euselasiines, *E. mystica* (Schaus), *E. aurantiaca* (Godman & Salvin) and *H. noctula* Westwood, are described here.

Larvae were examined with a Wild stereomicroscope. Material for scanning electron microscopy was coated with gold-palladium in a Hummer V sputter coater, and micrographs taken with an ISI Super IIIA.

All three species have the same distribution pattern of PCO's. Some are scattered along lateral and posterior margins of the prothoracic shield (Fig. 1). All remaining PCO's on larvae are restricted to clusters around abdominal (A) spiracles (Fig. 2). Long, tactile setae, present elsewhere on the larvae are absent from these clusters, though they may be immediately adjacent. The PCO's are set in fields of microtrichia (Figs. 2–4). The numbers of abdominal PCO's on larvae of the three species are as follows (A segment