the genitalia of the dissected male are identical to those of the Texas male and probably were capable of normal function.

What is the fate of *D. myron* in Thailand? *Polyalthea* was introduced to Thailand from India. It is grown widely as an ornamental in most towns and cities and along many major highways throughout Thailand. If *D. myron* can develop successfully on this host, there is no reason why the moth could not expand its range from Bangkok to encompass most of Thailand and perhaps beyond. Alternatively, *D. myron* may encounter native Vitaceae or Caprifoliaceae that it may be capable of using as a larval host plant.

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LONG-RANGE DISPERSAL AND FAUNAL RESPONSIVENESS TO CLIMATIC CHANGE: A NOTE ON THE IMPORTANCE OF EXTRALIMITAL RECORDS

Additional key words: distribution, *Nathalis iole, Phoebis sennae,* drought, El Niño.

On 27 June 1992 I collected a female *Nathalis iole* (Bdv.) (Pieridae) at Donner Pass, Nevada Co., California (2100 m). This was the second *N. iole* I had seen in the northern Sierra Nevada in 21 years of almost constant field work. Such extralimital records—the proverbial "strays" far from their normal ranges—can be found in almost all regional faunas. Although memorable to the individual collector, such records are typically not considered important. I would argue that in the context of global climatic change, such records are *biologically* important.

Because of its Mediterranean climate, California precipitation is tallied by "water year" (July 1–June 30), not calendar year. West of the Sierra-Cascade axis most of the precipitation falls from November to April. Mediterranean climates are geologically young and inherently unstable, with very high variance in precipitation on several time scales (Axelrod 1973, Major 1977, Fritts and Gordon 1980). 1992 was the sixth year of "drought" (as recognized by state and Federal agencies concerned with water management) in California. Although the intensity of "drought" and the definition of the term are subject to interpretation, biological indicators of drought stress were abundant. Levels of conifer morbidity and mortality in the Sierra Nevada reached 30–50% by late 1992, with firs (*Abies*, Pinaceae) particularly affected. Even with dramatically increased precipitation in winter 1992–93, the composition of Sierran vegetation already had been altered both qualitatively and quantitatively in ways which will persist for decades. We know from palynological, dendrochronological, and pedological data that such climatically-induced perturbations have occurred repeatedly since the end of the Pleistocene throughout the mid-latitudes of the Northern Hemisphere, including the Sierra Nevada (R. Byrne pers. comm.). These have resulted in reconfiguration of the species mixes defining "communities," as well as the altitudinal distributions of species and species assemblages.

The peculiar weather in the Sierra Nevada in 1992 constituted not only an exacerbation of the "drought" but a remarkable simulation of the projected impact in the Sierra of systematic global "greenhouse" warming (Botkin et al. 1991). In this scenario snowpacks will be lighter and will melt very rapidly roughly a month earlier than now (at 2000 m), resulting in a nearly instantaneous transition from winter to early summer conditions. May 1992 temperatures at Donner Pass were near to slightly above historic June norms; snow was entirely gone by early May. A great many organisms appeared four to six weeks earlier than historic (20 yr) norms, and for many butterflies population densities were remarkably high. Although spring 1992 is probably not a result of global warming (indeed, the combination of El Niño and stratospheric albedo effects from Mount Pinatubo should have canceled out global warming in 1992), it gave a glimpse of what the biotic responses to "greenhouse" regimes might be. Of course, one year's experience does not permit extrapolation to longer-term impacts if such regimes were to be sustained or even intensified over many consecutive years.

1992 was a year of many extralimital records, perhaps one of the best in California. Several of these appear to have resulted from heavy rain in the deserts of southern California and Mexico—rains attributed in this case to El Niño, but also forecast in some global warming scenarios. In addition to the strongest migration of *Vanessa cardui* L. (Nymphalidae) since 1973, population outflow was especially evident in desert Pierids. *Nathalis iole* came north on both sides of the Sierra Nevada. There were several high-altitude records in the western Great Basin (C. Nice pers. comm.). On 28 September a male was taken in the Sacramento Valley (West Sacramento, Yolo Co.) and on 8 October another in the Suisun Marsh (Solano Co.). These are new northern records west of the Sierra.

Phoebis sennae marcellina Cramer (Pieridae) also came north. Between 2 May and 23 May I saw five individuals in the Sierra Nevada between 750 and 1770 m, more than I had seen in northern and central California in the preceding 20 years! I also received a report of a *Eurema mexicana* (Bdv.) (Pieridae) taken in the central Sierra Nevada (J. Ausland pers. comm.).

None of these species is likely to become a breeding resident in the short term. Climatic tolerances and availability of resources should see to that. *N. iole* genuinely feeds only on *Bidens* and certain other (mostly photosensitizing) composites. It might be able to breed on garden marigolds (*Tagetes*). *Phoebis* has no native hosts (caesalpinoid legumes) in northern California, and the few woody *Cassia* in gardens were killed in the December, 1990 freeze. In general, however effective their dispersal, phytophagous insects cannot colonize an area until suitable hosts are established. Nonetheless, the rapid appearance of desert Pierids in northern California after short-term weather anomalies implies that apparent barriers are much leakier than is usually thought.

There are thousands of extralimital records scattered in various journals, but few systematic collations of them (e.g., Kaisila (1962) for Finnish Lepidoptera or Hengeveld (1985) for Dutch Coleoptera). Even a cursory review of such data suggests some general patterns (the incidence of southern species far to the north is much greater than the reverse; high-altitude species descend less often than low-altitude ones ascend; seasonal migrators often transcend their normal limits). If directional climatic shifts ensue, today's extralimital records are probably giving us a foretaste of tomorrow's faunas—or at least of the sequence of colonizations to be expected. It is therefore not only worthwhile but important to publish them, and in particular to collate and interpret them, especially in a context of long-term faunistic monitoring (Goldsmith 1991).

This note was inspired by conversations with Roger Byrne (Geography, UC Berkeley) and Allan Ashworth (Geology, North Dakota State University) during a Quaternary seminar at Berkeley in Fall Semester 1992.

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EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY ON CERTAIN LIFE HISTORY TRAITS IN *ANTHERAEA MYLITTA* (SATURNIIDAE)

Additional key words: climate, tasar silk moth, emergence, seasonal variability.

Antheraea mylitta (Drury), the semi-domesticated tasar silk moth, produces three generations annually under commercial rearing conditions, i.e., July–August (rain), September–October (autumn), and November–December (winter). Eggs for commercial rearings are collected from mated females from the grainage—a specially designed, well ventilated house for storage of tasar silk moth cocoons. Emergence of moths occurs from diapausing pupae immediately before each of the rearing seasons. Diapause in the first generation (rain) lasts up to 15 days; that of the second generation (autumn) lasts up to 20 days; and that of the third generation (winter) lasts nearly 150 days. Life history features such as percent emergence, percent coupling, fecundity, and percent hatching of *A. mylitta* are variable between seasons. Some of this variation appears to be influenced by climatic conditions; Jolly et al. (1974) and Nayak and Dash (1989) have demonstrated the influence of climatological factors on reproduction in *A. mylitta*. Understanding the effect of environmental factors upon these life history parameters is important for the maintenance of an appropriate reservoir of cocoons for commercial silk production. Hence, we conducted this study to determine and quantify the relationship of temperature and relative humidity to moth emergence, coupling success, fecundity, and hatching.

Healthy cocoons of *A. mylitta* were collected at random from the commercial grainages at the State Tasar Research Farm, Durgapur, Orissa, India. The cocoons were collected in 5 replications of 1000 individuals at the beginning of each month throughout the rearing season in 1988. The cocoons of each replication were stored separately in wire mesh cages inside the grainages. Daily emergence of adults, along with their sex and mating activity (coupling) were recorded. After mating, females were allowed to oviposit in cardboard boxes. Fecundity and percent hatching were recorded each month. Ambient temperature and relative humidity inside the grainage were recorded daily. The data were analyzed statistically to identify correlations between environmental factors and percent emergence, percent coupling, fecundity, and percent hatching. Student's t-test