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This incomparable volume is the product of presentations and subsequent research on the Monarch Butterfly, *Danaus plexippus* initiated at international meetings during the 1980s. The *Symposium on the Biology and the Conservation of Monarch Butterflies* ("Moncon-1"), held in Cocoyoc, Morelos, Mexico, in 1981, focused

on the development of a scientific rationale for the protection of the overwintering sites in Mexico and the immediate urgency to provide objective supportive documentation for conservation efforts. The *Second International Conference on the Monarch Butterfly* ("Moncon-2"), convened 2-5 September 1986 in honor of Fred A. Urquhart, was organized by Julian P. Donahue and hosted by the Natural History Museum of Los Angeles County. This symposium had a strong emphasis on research on every aspect of the biology and conservation of the Monarch butterfly. The presentations were subsequently divided into eight major subheadings: (1) systematics, (2) chemical communication, (3) mating behavior, (4) hostplant use, cardenolide sequestration, and defense against natural enemies, (5) physiological ecology and the annual cycle, (6) migration, (7) overwintering biology, and (8) conservation. Long in gestation, this volume has been updated and revised to include detailed research findings following the symposium. Separate black and white and color photographs introduce and provide convenient interludes between each major section. A list and current addresses of the contributors and a lengthy index complete this excellently produced volume.

Stephen Malcolm and Myron Zalucki provide a brief introduction and present an updated overview of the current status of the research and conservation on the Monarch butterfly in comparison with other well-known organisms as research models. Kitching, Ackery and Vane-Wright summarize the systematic relationships and evolution of the nymphalid subfamily Danainae in light of recent analyses derived from immatures and allozyme studies and present a historical perspective on the possible origins.

The second section features chemical ecology and reviews the systematic complexity of Danainae with the characteristic cardiac glycosides and other toxic secondary compounds such as the pyrrolizidine alkaloids, long known in other Lepidoptera but more recently detected in many of the danaines. Courtship behavior is summarized through detailed studies on the chemical mediation of male secondary sexual characters and the physiology of pheromone-sensitive receptor neurons.

Mating behavior is examined with a review of sexual selection and reproductive fitness in overwintering populations of Monarch butterflies in Mexico. Comparative studies on both Mexican and Californian populations investigate multiple mating, male fitness, survival rates and male vs. female vs. hostplant distributions.

Under host plant use and chemical defense against natural enemies, the mechanisms for cardenolide sequestration and resource partitioning are postulated and discussed. The final two papers in this section reinforce the need to critically reexamine previous information in the literature. Borkin reappraises and refutes the earlier accounts of *Apocynum androsaemifolium* and *A. sibiricum* as possible larval hostplants for *D. plexippus*. Similarly, Ritland and Brower present evidence that the mimicry relationships among Viceroy's, Queen's, and Monarchs are not as well defined as once believed. This mimicry complex may be a more dynamic one shifting along a continuum from Batesian to Mullerian mimicry due to variation in spatial, temporal and seasonal factors.

The next section reviews the interrelationship of physiological ecology and the annual cycle. This research encompasses a particularly diverse set of topics from juvenile hormone in the reproductive cycle, neuropeptide control of diuresis and diglyceride levels for flight metabolism, to thermoregulation through behavioral plasticity, morphological adaptations, and physiological acclimation.

Migration and overwintering biology are the interrelated themes for the last two sections. Dick Vane-Wright's erudite discussion on the Columbus Hypothesis proposes a possible explanation for the dramatic range expansion of the Monarch butterfly in the 19th century. Other authors examine the ecology (including plant interactions), physiology, social interaction, and migratory patterns in Australia,

Costa Rica, and several sites in the U.S. There are comprehensive studies focused on predator/ prey relationships in respect to chemical defenses and the cyclic nature of reproductive cycles in several danaines at one site.

The final section discusses the question of preservation and conservation of the Monarch butterfly, especially in North America. The fragmentation and loss of available habitat combined with the potential loss of overwintering roosting areas could certainly have severe deleterious effects on the butterfly populations in future years. The implementation of conservation initiatives versus the "anthropocentric considerations of sociology, politics, and economics" underlie the major problems involved in protection and preservation of species at multiple sites, and these issues are examined in detail.

With a multi-authored volume such as this, it is sometimes difficult to organize sections appropriately and have similar scientific breadth. This compilation succeeds admirably, is remarkably well written and edited, and is an invaluable compendium of the knowledge available on this unique butterfly species until approximately 1991. In a few cases, the reviews of previous and present research are perhaps too abbreviated, but each paper has a separate bibliography for additional reading which is an invaluable asset. With an organism such as *Danaus plexippus* that has been studied in such depth, it is remarkable to note how much information investigators have been able to amass and how much more knowledge is still required, for example on factors affecting behavior during migration.

Despite your particular area of research or endeavor, this volume is a must for any avid, working lepidopterist, and definitely sets a higher standard for future research on the Lepidoptera.

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