

TABLE 1. Continued.

Family	Species	Larval foodplant
	<i>Peridroma saucia</i> (Hbn.)	General feeder
	<i>Diaris jucunda</i> (Wlk.)	Grasses
	<i>Eurois stricta</i> Morr.	General feeder on woody plants
	<i>Xestia dolosa</i> Franc.	General feeder
	<i>Xestia normaniana</i> (Grt.)	General feeder
	<i>Xestia smithii</i> (Snell.)	General feeder
	<i>Xestia oblata</i> (Grt.)	General feeder on low plants
	<i>Metalepsis fishii</i> (Grt.)	<i>Vaccinium</i> ^{2,3}
	<i>Anaplectoides prasina</i> (D. & S.)	General feeder on low plants
	<i>Eueretagnotis perattenta</i> (Grt.)	General feeder

¹ Tietz, 1972, An Index to the Described Life Histories, Early Stages and Hosts of the Macrolepidoptera of the Continental United States & Canada. 11, A. C. Allyn, Sarasota, 1041 pp.

² Rockburne & Lafontaine (1976).

³ Ferguson, 1975, U.S. Dept. Agric. Tech. Bull. 1521, 49 pp.

⁴ McCabe, 1981, J.N.Y. Entomol. Soc. 89(2): 59-64.

Can. Dept. Agric. Publ. 1593. 164 pp., 613 figs.) refused to eat the artificial diet. Both species were subsequently reared on previously recorded host plants.

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EGG PLACEMENT BY *PHOEBIS* (PIERIDAE) ON *CASSIA* (LEGUMINOSAE) "ANTICIPATES" THE TROPICAL RAINY SEASON

As the tropical dry season advances, one common response by green plants is a progressive loss of leaves, which is sometimes accompanied by a gradual development of new leaf buds near the end of this period (Janzen, 1967, *Evolution* 21:620-637). By the time the rainy season is underway, such a plant species exhibits considerable leafing-out, providing herbivorous insects with an expanded food base. At any given Central American locality, not all plant species respond to the same degree to the dry season.

At "Finca La Tigra" on the Atlantic slope (220 m elev.) of Costa Rica's Cordillera Central (near La Virgen, Heredia Province, 10°23'N, 84°07'W) the plant family Leguminosae exhibits a broad range of dry season response patterns during the longer of two dry periods characteristic of this Premontane Tropical Wet Forest locality (Fig. 1). Many legume genera remain fully leaved throughout the major dry season, although the production of new leaf buds is often low. Others remain evergreen and exhibit considerable leaf replacement at this time. Still others, such as the roadside shrub or small tree (canopy height 2-5 m), *Cassia fruticosa* Mill., exhibit considerable loss of mature leaves, followed by a gradual development of new leaf buds in the latter part of the major dry period, which usually extends from late December through March. This is also a period of greatly reduced flowering and complete absence of fruits on *C. fruticosa* (Allen M. Young, unpubl. data, 1973-1982). The guild or assemblage of herbivorous insects associated with this tree species must cope physiologically and behaviorally with this annual cycle of seasonal changes in the availability of various edible plant parts.

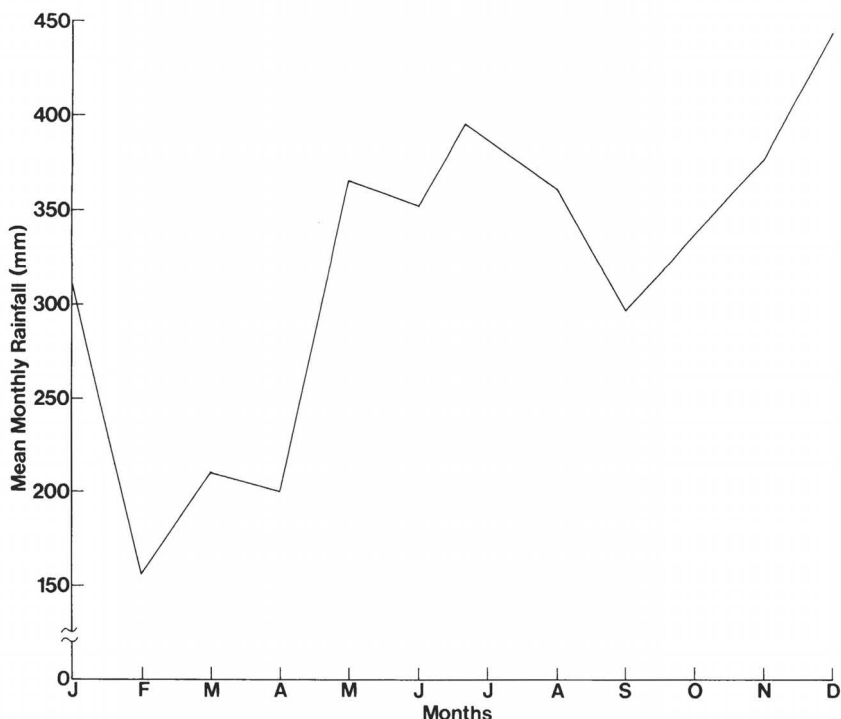


FIG. 1. Pattern of monthly rainfall at "Finca La Tirimbina," near La Virgen, Heredia Province, Costa Rica. Note the short dry season occurring in February and March.

In this note, I report that the pierid butterfly *Phoebis argante* (Fabricius), which is very abundant at this locality as it is throughout much of Costa Rica and Central America overall, behaviorally circumvents the deciduous habit of *C. fruticosa* by preferentially placing its eggs singly on the developing leaf buds while avoiding the severely thinned-out canopy of mature leaves. On one roadside stretch at La Tigra, I observed frequent egg placement on *C. fruticosa* by *P. argante* on roughly 30 trees between 1978 and 1982, providing a sample of 68 observed oviposition acts in the major dry season (December–March). In addition, 35 oviposition acts were observed during the lengthy rainy season characteristic of this region (Fig. 1).

During the rainy season, *P. argante* frequently places eggs singly on the fresh, fully-expanded leaves of *C. fruticosa*, as it does for other larval food plants at this locality during both rainy and dry seasons (A.M.Y., unpubl. data). A good example of the latter is *Pentaclethra macroloba*, a legume tree that remains evergreen throughout the dry seasons at this locality. But in the case of *C. fruticosa* as a larval food plant, during the latter part of the major dry season eggs are placed singly only on the small (length 4–10 mm, $n = 30$ measured on 7 March 1982) leaf buds that are scattered below the canopy of old leaves. A female butterfly weaves through the branches of the tree until it finds a new leaf bud and carefully places an egg on it (Fig. 2). A butterfly may thus deposit anywhere from 1 to 6 eggs on a single tree during one visit. Leaf buds having eggs are sometimes avoided, although a single female may place multiple eggs on a given bud. Butterflies do not even "inspect" the older leaves of a tree's canopy (Fig. 2).

The stage at which *P. argante* places eggs on leaf buds is followed by a period of



FIG. 2. **Above:** Position of eggs of *Phoebis argante* on unfolding new leaf buds of a larval host plant, *Cassia fruticosa* (Leguminosae) at "Finca La Tigra" in March. **Below:** The thinned-out canopy of mature leaves of *Cassia fruticosa* as it appears during February and March at "Finca La Tigra."

rapid growth and expansion of the buds, a condition that precludes the necessity of a potential egg diapause at this locality. The degree to which Neotropical pierids have diapausing eggs is unknown. The condition of rapid leafing-out is analogous to the availability of new leaf buds precluding the need for a reproductive diapause mechanism in the adults of butterfly species at such a locality. Eggs deposited on leaf buds in late February generally hatch in less than 10 days, and by this time the new leaves are considerably larger (expanded). Fresh adults of *P. argante* are found at this locality throughout the year, indicating a continuous breeding population structure made possible by (1) the behavioral flexibility that allows *P. argante* to place eggs on several alternate leguminous food plants at any one time, and (2) behavioral flexibility permitting different types of egg placement on a food plant that exhibits a markedly deciduous habit in at least the major dry season. Placing eggs on new leaf buds juxtaposes newly hatched larvae with a fresh food supply, and perhaps does so before other members of the herbivore guild associated with the leaves of *C. fruticosa* discover this resource at the beginning of the rainy season.

Such observations suggest that flexibility in egg placement behavior in a butterfly species that exploits a food plant with a deciduous habit is an effective mechanism by which the insect "anticipates" the expanded food supply of fresh, and perhaps, more edible, leaves, that will be available at the beginning of the tropical rainy season. Such a behavioral response permits the butterfly to breed throughout the year at such a locality. As with many Neotropical butterflies, *P. argante* possesses an egg-to-adult developmental period of about 40 days, including a larval period of 22 days, a period sufficiently long enough to "pace" development with the growth of new, highly edible, leaves of the larval food plant. Because this butterfly is geographically widespread throughout the Neotropical Region (Seitz, 1924, *Macrolepidoptera of the World*, Vol. 5: American Rhopalocera, Stuttgart: A. Kernan, 615 pp.; Howe, 1975, *The Butterflies of North America*, New York: Doubleday, 633 pp.), and because it exploits a range of *Cassia* species (d'Almeida, 1940, *Arq. de Zool. Estado de Sao Paulo, Revista do Museu Paulista* 1:67-152; Biezanko, 1959, *Arq. de Entomol. Minist. Agric. Brasil. Ser. B*; Teitz, 1972, *An Index to the Described Life Histories, Early Stages and Hosts of the Macrolepidoptera of the Continental United States and Canada*, Allyn Museum, 1041 pp.; Howe, op. cit.), regional or local larval food plant differences and the degree of seasonality are major determinants of whether or not the insect will exhibit the form of egg placement behavior described in this note. It is well known that many Lepidoptera species preferentially place eggs on fresh leaves of the food plant, regardless of a seasonal cycle in the availability of new leaves and other vegetative parts used as food. Presumably such plant parts are more edible for small caterpillars in the sense of having fewer defensive compounds (concentration, or range in types) and other barriers to successful feeding. What this present paper suggests is that in tropical regions with one or more dry seasons, we must view such preferences through the evolutionary lens of effects of the dry period on the supply of fresh leaves.

Not all legume-feeding Lepidoptera at this locality preferentially oviposit on young or fresh leaves. Even though the common woody legume vine *Machaerium seemanni* also flushes out new leaves in the dry season here, *Morpho peleides limpida* Butler and *Morpho granadensis polybaptus* Butler (Morphidae) place their eggs singly on the mature leaves of the vines (Young & Muyschondt, 1973, *Carib. J. Sci.* 13:1-49; Young, 1974, *J. Lepid. Soc.* 28:90-99; Young, 1982, *J. New York Entomol. Soc.* 90:35-54), even in the presence of young leaves. Newly flushed leaves in a leguminous food plant, therefore, may not always be more biologically suitable as larval food than the mature leaves of the same plant. But in the case of the *P. argante* × *C. fruticosa* association in Central America, newly flushed leaves may be more suitable as larval food than older leaves on the same trees. When 10 newly hatched first-instar larvae of *P. argante* were offered the old leaves of *C. fruticosa* that were present on trees in late February, some larvae nibbled at the edges of leaves, but all died within two days. A simultaneously studied set of another 10 first-instar larvae reared on the leaf buds where eggs were placed by ovipositing butterflies all developed normally during the same period, and none died. Clearly in this case, if we eliminate the bias of small sample size, older leaves of *C. fruticosa* available late in the dry season in Costa Rica are markedly unsuitable for

proper larval development in *P. argante* than newly unfolding leaves available at the same time. I suspect that full-sized mature leaves of *C. fructicosa* available in the rainy season are also highly unsuitable to *P. argante* larvae, before these leaves assume the brittle and blotched appearance that characterizes them in the dry season.

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CHERMOCK, HOVANITZ AND WEBER COLLECTIONS DONATED TO ALLYN MUSEUM

Among other accessions during 1980 and 1981 received by the Allyn Museum of Entomology of the Florida State Museum were three large and very significant collections of Rhopalocera donated by the heirs of Franklin H. Chermock, William Hovanitz and Bernard H. Weber. All of these collections have filled great gaps in the coverage of the Museum's holdings, especially in Arctic species and in the specialty groups of each of the donors.

Franklin H. Chermock collected and studied Lepidoptera assiduously and enthusiastically for over forty years until his death in 1967. Much of his early taxonomic work was done in collaboration with his brother, the late Ralph L. Chermock, and their investigations into the fauna of the Riding Mountains, Manitoba, were enormously valuable scientifically, resulting in the descriptions of many endemic butterflies from that region. Dr. Chermock's interest in Canadian butterflies continued up to the time of his death, and in company with his son, the late Paul W. Chermock, Frank collected and studied the butterflies throughout northern Manitoba and much of the Northwest Territories. The Chermocks, father and son, intended to describe many new taxa from these expeditions and distributed innumerable manuscript "paratypes" of these butterflies, many of which have been named subsequent to Frank's death by other authors. The Chermock collection contained 56,154 specimens (nearly all from the Nearctic), including 20 holotypes, eight allotypes, five syntypes and nearly 2000 paratypes, many from other authors. The "type series" of 56 proposed taxa were included and labelled. About 1300 microscopic genitalia slides and a useful library augmented the collection itself, along with a sizable body of correspondence relating to it. The Chermock material has provided the Allyn Museum collection with its first significant holdings in Arctic and Subarctic butterflies, and we are grateful to Frank's daughter, Mrs. Linda C. Hassinger, for the opportunity to preserve it and make it available for study.

William Hovanitz collected and studied Rhopalocera for about forty years before his untimely death in 1977. He was best known for his genetic and variational studies; the personally collected material for these studies is preserved in his collection. He had no parochial bias, and those groups that were of special interest to him are represented in the collection from throughout their ranges, especially *Colias*, Argynniinae and *Oeneis*. The Hovanitz material included 23,859 specimens, including more than 4400 *Colias*, significant numbers of which were from the Arctic of Canada and Alaska and from outside the Nearctic (especially the Andes of Peru, Bolivia, Chile and Argentina). One of the most valuable parts of the collection is material taken along a transect of the Alaska Highway from about Grande Prairie, Alberta (before the beginning of the Highway) to Tok Junction, Alaska. While this collection is particularly strong in *Colias*, other groups are well represented, such as *Clossiana*, *Oeneis* and the "blues." The only type material in the collection were two paratypes of *Colias thula* Hovanitz and two Bang-Haas *Colias*