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LARVAL FOODPLANTS FOR TWENTY-ONE SPECIES OF SKIPPERS (LEPIDOPTERA: HESPERIIDAE) FROM MEXICO[1]

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This is the second in a series of papers dealing with larval foodplants for Mexican Lepidoptera. In the first paper, Kendall (1975) gave larval foodplants for some Lycaenidae with a brief description of the study area. Given here are larval foodplants for 14 Pyrginae, including confirmation of 1 previously recorded, and 7 Hesperiinae from the same general study area in eastern Mexico. Unless otherwise stated, collections were made at Ciudad Mante, Tamaulipas, Mexico and vicinity. One of the skippers was recently described by Hayward, 3 more by Evans, and still 3 more by Freeman; the others were described during the 18th and 19th centuries. Seven of the species also are found in Texas. Spatial distribution may be found in Hoffman (1941), Evans (1952-1955), Monroe & Miller (1967), Brown & Mielke (1967, 1968), and Freeman (1969). Biological arrangement follows Evans (1952-1955); botanical arrangement, generally that of Standley (1920-1926).

Phocides polybius lilea (Reakirt) 1866

Larvae were found in leaf shelters on *Psidium guajava* L., MYRTACEAE, 17-XII-73 (3), 18-XII (2), 20-XII (2), 2-I-74 (1). Of the 8 larvae collected, 5 were parasitized; numerous adult parasites emerged 1-I-74. Three larvae pupated 6-I-74 (1), 10-I (1), 1-II (1); the last pupa and several parasitized larvae were preserved. Adults emerged 23-I-74 (♂), 28-I (♂). Comstock & Vazquez (1961) found larvae eating this plant, and they illustrated the last instar larva and 3 views of the pupa.

This species is established also in extreme south Texas where the larval foodplant is grown mostly as an ornamental. Lipes (1961) found larvae on this plant in Brownsville, Texas and reared them through. Since that time, Kendall and several other local collectors have found larvae on *P. guajava* and reared them through. It is interesting to note that the larvae are nocturnal feeders; consequently, the best time to find them is at night.

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Polythrix mexicanus Freeman 1969

Larvae were found in leaf shelters, feeding on *Ichtyomenthia communis* Blake, LEGUMINOSAE, 2-XII-73 (1), 29-XII (2), 30-XII (8), 16-I-74 (1), 22-II (1); at El Salto Falls, San Luis Potosí, 24-XII-73 (3), and near Tamazunchale, San Luis Potosí, 20-II-74 (1). Near Cd. Mante, 1 larva was found eating *Amerimnon granadillo* Standley, LEGUMINOSAE, 16-I-74. Larvae were mostly on small cut-over plants growing along the highways. Of the 18 larvae collected, 10 were parasitized; these with 3 pupae were preserved. Larvae pupated 30-XII-73 (1), 27-I-74 (1), 5-II (1), 6-II (1), 11-II (1), 22-II (1), 16-II (1), 28-II (1); adults emerged 10-II-74 (♀), 19-II (♀), 20-II (♂), 28-II (♀), 15-III (♂).

Heitzman & Heitzman (1972) published the first Texas and United States record of this species; specimens were collected 28-VI-68 in Bentsen-Rio Grande Valley State Park, Hidalgo Co., Texas. McGuire collected a ♀, 20-X-73 at Brownsville, Cameron Co., Texas.

Polythrix procerus (Plötz) 1881

Larvae were collected in leaf shelters on *Terminalia catappa* L., an ornamental, and *Laguncularia racemosa* (L.) Gaertin., both COMBRETACEAE, 20-XII-72 (2), 21-XII-73 (2), 11-I-74 (1), 22-I (1), 6-II (1), 11-II (1). Four unhatched but parasitized eggs were found 6-II-74, and these with several larvae and pupae were preserved. Larvae pupated 3-II-74 (1), 4-II (1), 10-II (1), 27-II (1); adults emerged 19-II-74 (♀), 20-II (♂). Adult parasites emerged 15-II-74 and were preserved. Four more larvae were collected on *T. catappa* 9-XI-74 (1), 10-XII-74 (3); these pupated 20-XII-74 (1), 16-I-75 (1), 6-II (1), 18-II (1); adults emerged 4-I-75 (♀), 2-II (♂), 28-II (♀), 10-III (♀).

Codatractus alcaeus alcaeus (Hewitson) 1867

Three larvae were collected 24-XII-73 in leaf shelters on *I. communis* at El Salto Falls, San Luis Potosí. Two of these were parasitized; the other attempted pupation but died; all were preserved. Near Cd. Mante larvae were also collected on this plant 22-XII-73 (1), 29-XII (1), 19-I-74 (1); 2 of these were parasitized; the other pupated 31-I-74 but died; all were preserved. Still another larva was found feeding on *A. granadillo* 29-XII-73; it pupated 9-I-74, and a ♀ emerged 16-II-74. Texas records include: Freeman (1951), Heitzman (1970), and McGuire a ♀ 19-X-73 at McAllen, Hidalgo Co., Texas.

Astraptes fulgerator azul (Reakirt) 1866

Larvae were collected in leaf shelters on *Karwinskia humboldtiana* (R. & S.) Zucc., RHAMNACEAE, 18-XII&-73 (1), 20-XII (2), 21-XII (2), 30-XII (1), 1-I-74 (3). Eggs were collected 21-XII-73 (1), 1-I-74 (2); these and 3 larvae and 3 pupae were preserved. One larva was parasitized by dipterons. Larvae pupated 13-I-74 (1), 17-I (1), 20-I (1), 6-II (1), 9-II (1), 21-II (1); adults emerged 30-I-74 (♂), 3-II (♂), 7-II (♂). At El Barretal, Tamaulipas, 1-III-74, 1 larva and 4 eggs were collected on *K. humboldtiana;* the larva pupated 20-III and a ♂ emerged 14-IV-74. One egg was preserved; the other 3 hatched 6-III-74; 2 of the young larvae perished; the other pupated 14-IV, and a ♂ emerged 1-V-74.

Comstock & Vazquez (1961) collected 1 larva eating *Vitex mollis* H. B. K., VERBENACEAE. They gave good illustrations of the last instar larva and pupa. In Texas the larvae eat *K. humboldtiana.*

Astraptes gilberti Freeman 1969

At El Salto Falls, San Luis Potosí, 24-XII-73, Mrs. Kendall found the first larvae of this species feeding on *Bauhinia divaricata* L., LEGUMINOSAE. Before

leaving the Falls, we had collected 31 larvae. Twenty larvae, most of which were parasitized, and 5 pupae were preserved. Larvae pupated 30-XII-73 (1), 1-I-74 (1), 8-I (1), 9-I (1), 11-I (1), 13-I (1), 14-I (1), 19-I (1), 22-I (2), 24-I (1); adults emerged 17-I-74 (♂), 23-I (♀), 29-I (♂), 3-II (♀), 6-II (♀), 8-II (♀). Five larvae were collected 4-I-74 on the same plant near Cd. Mante; larvae pupated 12-I-74 (1), 17-I (1), 18-I (2); adults emerged 28-I-74 (♂), 4-II (♀). Two larvae and 1 pupa were preserved.

Freeman pointed out in his original description that what he had earlier (1945) reported for the United States as *A. hopfferi* (Plötz) should be *A. gilberti.* Kendall found the latter common near Linares, Nuevo Leon, a spot relatively near to Texas, still the only records we are aware of from Texas are those of Freeman (1945, 1969); M. A. Rickard, 1♀, 29-X-71 Madero, Hidalgo Co.; and McGuire, 1♀, 19-X-73 6 mi. W of Mission, Hidalgo Co.

Celaenorrhinus similis stola Evans 1952

On 29-I-74, Mrs. Kendall found 1 small larva in a leaf shelter on *Dolicholus longeracemonsus* (Mart. & Gal.) Rose, LEGUMINOSAE. Again on 18-II-74, 2 larvae and 1 pupa were collected on this plant. All larvae were preserved; from the pupa a ♀ emerged 20-II-74. One larva produced a parasitic ichneumonid.

Cogia caicus moschus (Edwards) 1882

McGuire collected 2 larvae in leaf shelters on *Acacia angustissima* (Mill.) Kuntze, LEGUMINOSAE, 27-XII-73 at Gomez Farias, Tamaulipas. One proved to be parasitized; the other entered diapause within a day or two; it pupated 22-II-74 and a ♀ emerged 5-III-74. At the same location and plant, Kendall collected 5 larvae, 19-XI-74; three larvae were preserved, the other 2 entered diapause *ca.* 1-XII. The last 2 larvae pupated on or before 4-I-75; adults emerged 9-I-75 (♂), 14-I-75 (♀).

Arteurotia tractipennus tractipennus Butler & Druce 1872

One larva was collected 19-I-74 in a leaf shelter on *Croton niveus* Jacq., EUPHORBIACEAE; it pupated 5-II, and a ♀ emerged 18-II-74. Mrs. Kendall collected 2 more larvae 14-II-74 feeding on *Croton reflexifolius* H.B.K., one of which was preserved; the other pupated 27-II, and a ♂ emerged 10-III-74. Again on 11-XI-74, 1 pupa and 1 larva were found on *C. niveus;* the pupa produced a parasitic *Spilochalcis sp.,* 20-XI; the larva pupated 30-XII, and a ♂ emerged 10-I-75.

Paches polla Mabille 1888

The Kendalls collected immatures of this species in leaf shelters on *Buettneria aculiata* Jacq., STERCULIACEAE. Pupae were found 27-I-74 (2), 30-I (1), 6-II (1), 22-II- (1); one produced a ♀ 3-II-74, the others were parasitized. Larvae were collected 31-I-74 (2), 6-II (4), 13-XI (9), 21-XI (1); larvae pupated 4-II (1), 28-II (2), 1-III (1), 18-XI (1), 21-XI (1), 23-XI (1), 26-XI (1), 30-XI (1); adults emerged 17-II-74 (♀), 7-III (♂), 10-III (♀), 12-III (♀), 28-XI (2♀), 3-XII (♀), 8-XII (♂), 16-XII (♀). Five parasitized pupae and 6 larvae (2 parasitized) were preserved. An adult parasitic dipteron emerged 18-XII-74.

An interesting larval habit of this species is to cut and fold under a portion of the leaf which remains attached by a single vein; the larva then eats small holes in this portion, thus producing an "air conditioned" shelter. Sometimes the cut portion is folded over the leaf. This larval habit was observed for *Quadrus lagubris* Felder which will be treated in a separate paper because the larval foodplant is not yet determined.

Antigonus erosus (Hübner) 1812

Comstock & Vazquez (1961) described and illustrated the last instar larva and pupa of this species, but they were unable to identify the larval foodplant. Their illustration of the larva does not compare too well with our larvae, especially the larval head. Our reared adults check perfectly, however, with Evans' key for the species.

Two larvae were collected 20-XII-72 in leaf shelters on *Guazuma ulmifolia* Lam., STERCULIACEAE; these larvae were preserved for later determination. Twenty-six more larvae were collected on this plant between 17-XII-73 and 27-I-74. Nineteen larvae were preserved, most of which were parasitized. Other larvae pupated 8-I-74 (1), 9-I (1), 14-I (1), 16-I (1), 24-I (1), 25-I (1), 27-I (1); adults emerged 18-I-74 (♀), 23-I (♀), 29-I (1♂, 1♀), 8-II (♀), 9-II (♂), 13-II (♀). On 8-XI-74 near Llera, Tamaulipas, Kendall observed a ♀ oviposit on the foliage of this plant; the ♀ and 5 eggs were preserved. At Cd. Mante, Kendall collected 7 larvae, 9-XI-74 and 2 more 4 & 18-XII-74. Larvae pupated 25-XI (1), 9-XII (2), 12-XII (1); adults emerged 10-XII (♂), 17-XII (♀), 21-XII (♀); 5 larvae and 1 pupa were preserved. At El Salto Falls, San Luis Potosí, the Kendalls collected 3 more larvae 16-XII-74, and 1 on 25-XII; larvae pupated 29-XII-74 (2), 12-I-75 (1); a ♀ emerged 27-I-75; 1 larva and 2 pupae were preserved.

Aethilla lavochrea Butler 1874

At Rancho Pico de Oro, Tamaulipas, the Kendalls collected 8 larvae and 1 egg, 9-I-74, 1 larva 22-I, and 1 larva 4-XII, on *Citrus aurantifolia* (Christm.) Swingle, RUTACEAE. Larvae pupated 2-III-74 (1), 3-III (1), 11-III (1), 19-XII (1); adults emerged 21-II-74 (♂), 1-IV (♀), 4-I-75 (♂). The egg, 7 parasitized larvae and 1 pupa were preserved. Eggs are deposited on the undersurface of the leaf edge. First instar larvae cut and fold over a portion of a juvenile leaf as a shelter; later instar larvae often pull two leaves together to form a shelter.

Achlyodes selva Evans 1953

About 35 km. WSW of Linares, Nuevo Leon, 3-III-74, the Kendalls collected 3 larvae, 5 pupae (4 of which were parasitized), 7 pupal cases, and 2 eggs on *Sargentia greggii* S. Wats., RUTACEAE. A ♂ emerged *ex pupa* 15-III-74. Two of the larvae were preserved together with the eggs and pupal cases; the remaining larva ate *Ptelea trifoliata* L. in the field lab and pupated 13-IV-74; a ♂ emerged 26-IV-74. In the Cd. Mante area 1 larva was collected 3-II, and 1, 4-XII-74; the first was parasitized, the other pupated 10-I-75 and a ♂ emerged 23-I-75. These last 2 larvae were feeding on *C. aurantifolia.*

Cycloglypha thrasibulus thrasibulus (Fabricius) 1793

At El Salto Falls, San Luis Potosí, 7 eggs, 9 larvae and 1 parasitized pupa were collected 24-XII-72 on *Platanus mexicana* Moric, PLANTANACEAE. All of these immatures were preserved for determination at a later time. At the same location, additional larvae were collected in leaf shelters on 24-XII-73 (10), 16-XII-74 (5), 25-XII (2); larvae pupated 8-I-74 (2), 10-I (2), 16-I (2), 17-I (2), 18-I (1), 21-I (1), 7-I-75 (1), 11-I (1); adults emerged 20-I-74 (♂), 27-I (♀), 28-I (♀), 30-I (♀), 31-I (♀), 3-II (♂), 18-I-75 (♂), 23-I (♀). Nine larvae were preserved, 4 of these were parasitized.

Orthos lycortas (Godman) 1900

In December 1970, C. J. Durden collected a sample of a plant, *Beaucarnea inermis* (S. Wats.) Rose, LILIACEAE, in Paso del Abra, Tamaulipas. He was unaware until 19-II-71 when a ♀ was found flying around in his study that hidden

in the foliage of this sample was a larva or pupa. A search disclosed the empty pupal case among the leaves of the botanical sample. Information on the undetermined plant and insect was relayed to the authors in XII-72. At this time an examination was made of one such plant near Antiguo Morelos, Tamaulipas without finding any sign of larval damage. On 22-XII-73, in Paso del Abra, Kendall climbed one of these tree-like plants with a large bulbus root and found 3 larvae and 1 unhatched egg. On the following day, we collected about 40 larvae and 1 pupa; the pupa and many larvae proved to be parasitized. On 13-II-74, 2 more unhatched eggs and 3 larvae were collected, and 2 more larvae 17-XI-74. Larvae pupated from 1 - 17-I-74, and 30-XI-74, adults emerged 13-I (2♂), 15-I(2♂), 16-I (♀), 17-I (♀), 18-I (♂), 20-I (2♂), 22-I (3♂, 2♀), 28-I (♀), 29-I (♂), 3-II (♀), 14-XII-74 (♂). In addition, 1 first instar larva collected 13-II-74 pupated 13-III, and a ♀ emerged 21-III-74. All eggs, 20 larvae and 3 pupae were preserved. Eggs are deposited on top of the leaves usually well within the foliage. Larvae form a shelter by pulling together the long leaves and forage off the tips.

It is interesting to note that until the above specimens were collected, this species was apparently known only from the unique type in the British Museum (N. H.), collected at an unknown location in Mexico, and 3 other specimens in H. A. Freeman collection. Two of the latter were collected at or near Ciudad de Valles, San Luis Potosí, and the third by Eduardo C. Welling, M. at Tenosique, Tabasco.

Niconiades nikko Hayward 1948

At Rancho Pico de Oro, 2 larvae were collected in leaf shelters on *Banbusa vulgaris* Schrad., BAMBUSEAE. These 2 larvae pupated 17-I-74; 1 produced a ♀ 31-I-74, the other a parasitic dipteron 5-II-74. Two more larvae were collected at this location 4-XII-74; both pupated 13-XII; a ♂ emerged 26-XII-74, the other pupa produced a parasitic dipteron 5-I-75. When fully mature, the larva cuts away its shelter so that it falls to the ground where pupation takes place in the shelter (a similar larval habit is shared by *Amblyscirtes nysa* Edwards).

Lerema ancillaris liris Evans 1955

At Cd. Mante, this species was found quite common around the Los Arcos Courts, and a ♀ was observed ovipositing on a broad-bladed grass, GRAMINEAE (sp. undet.), 19-XII-73. Twenty-six eggs were deposited within 3 days by the captive female, and these started hatching 29-XII-73. Like *Lerema accius* Smith, the larvae did not refuse any species of grass offered; in fact, larvae were found on sugar-cane, *Saccharum officinarum* L. and *Bambusa vulgaris*. The larvae pupated 30-I-74 (1), 1-II (2), 3-II (2), 5-II (4), 8-II (1); adults emerged 11-II-74 (2♂), 13-II (♂), 16-II (♂), 17-II (1♂, 2♀), 19-II (♀). Six eggs plus larvae and pupae were preserved. From larvae found in nature, pupation occurred 26-XII-73 (1), 30-XII (1), 4-I-74 (1), 7-I (1), 8-I (2), 10-I (1), 11-I (1), 31-I (1); adults emerged 9-I-74 (♀), 16-I (♂), 19-I (♂), 20-I (3♂), 13-II (♀). Several larvae collected in nature were parasitized.

Kendall (1970) first recorded this species for Texas and the United States. McGuire collected 2♀, 20-X-73 at Relampago, Hidalgo Co., Texas.

Perichares philete adela (Hewitson) 1867

Adults were very common from 17-XII-73 to 2-I-74, and a ♂ was collected as late as 21-I-74. Kendall collected 2 larvae and 2 pupae 20-XII-73 on sugarcane, *S. officinarum*. Also, he collected 1 pupa 9-I-74, and 1 larva 2-II-74 on *B. vulgaris*. Two parasitized pupae and 2 larvae were preserved. One pupa produced a ♀ 25-XII-73, and the remaining larva pupated 27-XII, and a ♂ emerged 11-I-74.

Freeman (1951) recorded 2 examples of this species from Texas *(P. phocion dolores* (Reakirt)). So far as we can determine no other examples have been collected in the United States.

Quinta cannae (Herrich-Schäffer) 1869

For nearly a month Kendall had observed rolled leaves on *Canna indica* L., MUSACEAE, growing in the Los Arcos Courts gardens, but he had assumed them to be larval shelters of *Calpodes ethlius* (Stoll). On 1-II-74 he decided to collect and preserve a few immatures for the record. It was obvious from the first larva examined that it was not *C. ethlius*. Two larvae and 7 pupae (4 parasitized) were collected at this time. On the following day another small larva and 1 pupa were found. Nineteen eggs were collected from the undersurface of the leaves 23-II-74 (*C. ethlius* deposits eggs on the upper surface); all except 2 of these eggs had been predatorized; a very small "bug" was observed piercing an egg with its proboscis and sucking out the contents leaving only the empty shell. The 2 eggs hatched 1-II-74 but died later, probably due to improper care. Adults emerged from pupae 4-II-74 (♀), 7-II (♂), 14-II (♀). Three more larvae were collected 9-XI-74; 1 larva was parasitized, the other 2 pupated on 16 & 22-XI; adults emerged 26-XI (♂), 4-XII-74 (♀).

Several empty pupal cases of *C. ethlius* were found in rolled leaves, but none was collected. The mature larval habit of *Q. cannae* differs significantly from that of *C. ethlius* in that the former, when fully mature, cuts the main stem of the leaf almost completely in two so that it falls to the ground and slowly withers. It is in this portion on the ground that pupation occurs. Immatures consisting of 4 larvae, 5 parasitized pupae, 6 empty pupal cases, *ca.* 15 egg shells with 1 "bug" egg-predator were preserved.

Tirynthia huasteca Freeman 1969

Freeman (1969) described this species from 5 specimens collected about 140 air km. south of where immatures were found. Three larvae were found in funnel-like shelters constructed at the other end of the leaf of *Bambusa vulgaris*, 9-I-74. In the field lab larvae pupated in the "funnel" shelters 19-I-74 (1), 24-I (1), 30-I (1); adults emerged 3-II-74 (♀), 7-II (♀), 15-II (♀). Pupal shells were preserved.

Niconiades xanthaphes Hübner 1821

A single larva was found feeding on *B. vulgaris* 9-I-74; it pupated 22-I, and a ♂ emerged 5-II-74.

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LITERATURE CITED

Brown, Keith S. Jr., & Olaf H. H. Mielke, 1967. Lepidoptera of the central Plateau. I. Preliminary list of Rhopalocera. J. Lepid. Soc. 21:145-168.

————————, 1968. II. Partial list for the Belo Horizonte area, showing the character of the southeastern "blend zone." J. Lepid. Soc. 22:147-157.

Comstock, John A. & Leonila Vazquez G., 1961. Estudios de los ciclos biologicos en Lepidopteros Mexicanos. Anales del Instituto de Biología 31:349-448.

Evans, W. H., 1952. A catalog of the American Hesperiidae indicating the classification and nomenclature adopted in the British Museum. Part II. Pyrginae. Sec. 1. London: British Museum, 178 pp., pls. 10-25.

————, 1953 ..... Part III. Pyrginae. Sec. 2. London: British Museum, 246 pp., pls. 26-53.

————, 1955. ..... Part IV. Hesperiinae and Megathyminae. London: British Museum, 449 pp., pls. 54-88.

Freeman, H. A., 1945. Notes on some Hesperiidae, with new records for the United States. Ent. News 56:102-104.

————, 1951. Ecological and systematic study of the Hesperioidea of Texas. So. Methodist Univ. Studies 6:1-67.

————, 1969. Records, new species, and a new genus of Hesperiidae from Mexico. J. Lepid. Soc. S-2:1-62 incl. 15 pls.

Heitzman, J. Richard, 1970. A new U. S. butterfly record and a migration of *Eunica monima* in Texas. Mid-Cont. Lepid. Series 12:10-11.

Heitzman, J. Richard & Robert L., 1972. New butterfly records for the United States (Hesperiidae & Libytheidae). J. Res. Lepid. 10:284-286.

Hoffmann, Carlos C., 1941. Catalogo sistematico y zoogeografico de los Lepidopteros Mexicanos. Segunde parte - Hesperioidea. An. Inst. Biol. Mexico, 12:237-294.

Kendall, Roy O., 1970. *Lerema ancillaris* (Hesperiidae) new to Texas and the United States. J. Lepid. Soc. 24:266.

————, 1975. Larval foodplants for seven species of hairstreaks (Lycaenidae) from Mexico. Bull. Allyn Mus. 24:1-4.

Lipes, Jack E., 1961. More butterfly records from Brownsville, Texas, including a foodplant of *Phocides polybius* (Hesperiidae) J. Lepid. Soc. 15:114.

Monroe, Rose Sawyer, & Lee D. Miller, 1967. Report on a collection of Hesperiidae from Honduras. J. Lepid. Soc. 21:243-247.

Standley, Paul C., 1920-1926. Trees and shrubs of Mexico. Contributions, U. S. Nat. Herbarium, vol. 23, parts 1-5, 1721 pp., Gov't. Printing Office, Washington, D.C.