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BUTTERFLY LARVAL FOODPLANT RECORDS AND A PROCEDURE FOR REPORTING FOODPLANTS[1]

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INTRODUCTION

In recent years there has been much interest in the relationships between plants and butterflies (e.g., Brower and Brower, 1964; Ehrlich and Raven, 1965). In much of the past work the method of recording this data has been inaccurate and unsystematic. The importance of accurately determined larval foodplants of butterflies has been recognized by some workers but neglected by many others. Progress in this field has been slow; as late as 1947 there were a large number of North American species for which not a single foodplant was known, including certain common species (Remington, 1947b).

Larval foodplants aid in constructing the biology of the butterfly since spatial and temporal distribution, abundance, and sometimes the color pattern of the adult are directly dependent on foodplants. Thus, one of the keys to the biology of the butterfly ultimately depends on the precise identification of its larval foodplant(s). Although some species such as *Vanessa cardui* (Linnaeus) and *Strymon melinus* Hubner utilize a wide variety of plants, most species appear to be restricted to a few or even a single plant species. Butterfly foodplants may even help to determine plant distribution; e.g., *Speyeria* indicate that *Viola* is

[1]The term "foodplant" is used throughout this paper since it refers to a plant that the insect habitually feeds on, as opposed to "hostplant" which refers to a plant that the insect lives on (Torre-Bueno, 1937).

present, a plant that is sometimes not noticeable in a locality at certain times of the year.

In view of numerous errors now present in the literature, it is *critical* that a standardized procedure be established to more accurately determine foodplant-butterfly relationships, since no such procedure exists. In this work we propose a procedure for systematically identifying and reporting plant-butterfly records so that they can be referred to accurately and with assurance. We will also discuss past good and bad practices, methods used to find foodplants, and will report foodplant records for 14 butterfly species based on one season of observation. Additional records will be reported in future papers.

REVIEW OF LITERATURE ON FOODPLANTS; VALUE OF FOODPLANTS

Some literature concerning insect-foodplant relationships is available. A series of papers deal with food selection in phytophagous insects (Brues, 1924; Dethier, 1953, 1954, 1968; Fraenkel, 1953; Thorsteinson, 1960; Cartier, 1968; Schoonhoven, 1968). Discussions of the effects of available food in relation to oviposition and larval dispersal (Dethier, 1959a, b), visual and chemical stimuli used during oviposition (Ilse, 1937; Cripps, 1947; Fox, 1966; Schoonhoven, 1968), and the variation in selectivity of foodplants (Forbes, 1958; Straatman, 1962a; Stride and Strattman, 1962) are available for butterflies. Hovanitz and Chang (1962a, b, 1963a, b, c, d, e, 1964) performed a series of laboratory experiments with *Pieris* species, principally *Pieris rapae* L., to determine oviposition preferences and responses, factors affecting foodplant preferences of the larvae, and the effect of the foodplant onthe larva's survival and growth rate. Some work has been done with foodplant specificity in sibling species of butterflies (Remington and Pease, 1955; Remington, 1958. Emmel and Emmel (1962) discuss factors that limit butterfly species to particular foodplants and thus influence the amount of plant utilization. Downey (1962) found that foodplant association in *Plebejus icarioides* (Boisduval) may depend on other factors besides the particular lupine species, such as pilosity and hybridization in the plant, ant symbiosis, parasites, competitors, and soil types.

Three major sources to locate butterfly foodplants for North America are Edwards (1889), Davenport and Dethier (1937), and Dethier (1946). These cite the literature but do not critically evaluate the foodplants given. J. A. Comstock has published a series of life history studies of North American butterflies that includes foodplants, in *the Bulletin of the Southern California Academy of Sciences.* Kendall (1959, 1964, 1965, 1966) recorded foodplants for certain Texas butterflies, and Remington (1952) reported foodplants for some Colorado species. Detailed work has been done with the foodplants of one species, *Plebejus icarioides* (Downey and Fuller, 1961; Downey, 1962). Work on foodplants of butterflies in other countries (e.g., Scudder, 1874; Platt, 1921; Stokoe, 1944; Allan, 1949; Iwase, 1954, 1964; Dickson, 1965) may assist in finding new foodplants for North American species.

Although our knowledge of butterfly foodplants is at a far less complete state than butterfly taxonomy, foodplants have already proved to be a valuable tool in interpreting certain evolutionary trends. Effects of competition and predation on foodplant selection in butterflies are discussed by Brower (1958a, b). By analysis of foodplants of three closely related species of *Papilio,* Brower (1958b) suggests that competition among the larvae probably produced restricted and mutually exclusive diets. (However, D. V. McCorkle, personal communication, found larvae of two of these, namely *Papilio eurymedon* Lucas and *P. multicaudata* Kirby, feeding on the same *Prunus* species in Washington.) Brower (1958a) also found evidence that food preferences of butterflies that are procryptic and palatable to birds result from selective pressure favoring those on mutually exclusive plants due to birds concentrating on a common prey image. Brower and Brower (1964) found a strong correlation between adult butterflies being unpalatable to vertebrate predators and a narrow range of larval foodplants containing poisonous substances. Dethier (1941) examined various species of citrus and parsley families and found that these plants have certain essential oils in common that probably account for their attractiveness to *Papilio* larvae. Similarly, Ehrlich nd Raven (1965, 1967) concluded from a systematic evaluation of plants eaten by certain butterfly subgroups that butterflies may feed on plants distantly related phylogenetically but which contain similar secondary plant substances. From this they suggest that butterflies and plants are co-evolving. Breedlove and Ehrlich (1968) found that the seed set of *Lupinus amplus* Greene was strikingly reduced by larval infestation of *Glaucopsyche lygdamus* (Doubleday) in one lupine population in Colorado, indicating that this butterfly could be a strong selective agent on this plant species. Hovanitz (1949: 351, 353) points out that man can accelerate the rate of hybridization between two *Colias* species by disturbing the habitat and enabling weeds to encroach. *Colias christina* Edwards thus entered the dwarf willow habitat of *C. gigantea* Strecker in southern Canada and *C. philodice* Godart entered the *Vaccinium* habitat of *C. interior* Scudder in northern Michigan following their foodplant invasion along roadsides.

One practical aspect of knowing the foodplants for butterflies is in plotting the butterfly's distribution. For example, *Speyeria nokomis* (Edwards), a species usually found in isolated colonies, can be discovered in new localities by locating herbarium records for *Viola nephrophylla* Greene within its known range and elevation limits.

ERRORS

Past work dealing with butterfly foodplants has often been imprecise, inadequate, and erroneous. Burns (1964:18), in ascertaining *Erynnis* foodplants, said "rampant misidentification is a serious source of error, hard to detect," and lightly dismissed many old records. Downey (1962) said that "considerable error" exists for butterfly foodplants in the literature. He attributes this to (1) data based on single observations and (2) casual identification of the suspected plants. Ehrlich and Raven (1965), in summarizing foodplant relationships in butterflies, say that "extreme care has been taken in associating insects with particular food plants, as the literature is replete with errors and unverified records." They mention that despite erratic oviposition behavior often displayed by butterflies, oviposition records are frequently considered as foodplant records. Brower (1958b) pointed out sources of error from evaluating foodplants of three western United States *Papilio* species: (1) authors often failed to indicate whether or not they reared adults from larvae for positive identification, (2) worn females of the three species look alike in flight so that oviposition records without capturing the females are subject to error, and (3) later authors often quote earlier authors who were mistaken in their information.

Examples of the kinds of errors that are made may help focus attention on the pitiful state of our knowledge of butterfly foodplants and may suggest ways to remedy the situation. Tietz (1952) states that "every effort has been made to list all foodplants where they are known," but usually gives no references to the foodplants listed. He noted *Battus philenor* (Linnaeus) ovipositing on *Polygonum scandens* L. and thus listed it as a foodplant. Also, among *Euphydryas phaeton's* (Drury) food plants were listed *Ribes, Corylus,* and *Fraxinus,* all unlikely to serve as foodplants. Garth and Tilden (1963) did not designate foodplant species because it "would have prolonged the list unduly" and list genera for the most part. Edwards (1868-1872) reported *Polygonia zephyrus* (Edwards) on *Azalea occidentalis* (now known as *Rhododendron occidentale* (T. & G.) Gray) and later (1884) corrected his mistake in two places, saying that the larva and pupa that were drawn referred to *Polygonia faunus rusticus* (Edwards). Despite this correction many texts since have continued to list *Azalea* as a *zephyrus* foodplant. One of the present authors (JFE) reported (1962) that *Lycaena cupreus* (Edwards) larvae were found on *Calyptridium umbellatum* (Torr.) Greene; they were not reared to adult. Despite the fact that a female *cupreus* was seen to oviposit on the *Calyptridium* earlier in the season, it is probably not the foodplant; a later investigation of the area in 1965 by JFE revealed that a *Rumex* species, probably the true foodplant, was growing abundantly among the *Calyptridium.* The larvae that were found are now thought to have been *Strymon melinus,* but this is only speculation. This example emphasizes the need to follow through on observations of oviposition before considering a plant as a food source. One wonders how certain peculiar errors ever developed in the first place, such as *Neophasia terlooti* Behr feeding on "mistletoe" (Forbes, 1958). Stokow (1944) and Allan (1949) did not distinguish between laboratory and field rearings for species of foodplants of British butterflies.

Species are often said to feed on a common plant, implying that a particular species is a general feeder on that group of plants. For example, references to *Polygonia satyrus* (Edwards) on "nettle", *Satyrium sylvinus* (Boisduval) on "willows", and many satyrines and hesperiids on "grasses" are common. The inaccuracy of such statements is pointed out by the fact that not one specific grass genus, let alone species, is known for a North American satyrine. (However, N. McFarland, *in litt.,* reports a *Cercyonis* larva on *Dactylis glomerata* L. 5 miles W. of Corvallis, Oregon.) A sedge may be the foodplant of the satyrine *Euptychia mitchellii* (French) (McAlpine, Hubbell, and Pliske, 1960) and sedges are strongly suspected for at least one species of *Oeneis* (JFE and OS, personal observation).

Brower (1958b) traced one error down. Comstock had reported the foodplant for *Papilio rutulus* Lucas as "hop", which was reported elsewhere as *Humulus* when he meant *Ptelea Baldwinii* T. & G. (Hop-Tree). In *Philotes,* the *Eriogonum* foodplant is quite specific for any given population, yet Downey in Ehrlich and Ehrlich (1961) states that they feed on "*Eriogonum*".

One problem with erroneous foodplant determinations is that it is difficult to *unprove* them or even sometimes to distinguish them from legitimate records when no documentation accompanies the statement. Sometimes apparently legitimate records by reputable workers are erroneous, such as W. H. Edwards reporting *Papilio indra* Reakirt as feeding on *Artemisia dracunculus* L. (Emmel and Emmel, 1963). It will be a long, slow process to weed out erroneous records, and it would be advisable to duplicate legitimate records with adult and plant reference material. Records suspected to be erroneous should be corrected when new data dictates it. For example, Davenport and Dethier (1937) gave *Lotus glaber* Greene and *Astragalus* sp. as well as *Purshia glandulosa* Curran reported in the literature as foodplants for *Callipsyche behrii* (Edwards). The reference to *Purshia* is well documented (Comstock, 1927, 1928). The range of the adult corresponds to that of *Purshia* and the larvae have subsequently been found on *Purshia* but the other two records have never been duplicated. A look at the original source (Williams, 1908) reveals that the *Lotus* and *Astragalus* records refer to "*Lycaena behrii*", plainly a species of "blue" from the context.

At a somewhat lower level, subspecies of plants are not often given, although such a reference can be important. For example, *Papilio indra fordi* Comstock & Martin was originally described as feeding on *Cymopterus panamintensis* Coult. & Rose, although it does *not* occur on the nomotypical subspecies but rather only on the subspecies *acutifolius* (Coult. & Rose) Munz (JFE, unpublished). Sometimes certain records are common knowledge yet are not published; this is also a type of error.

Some authors are of the opinion that choice of foodplants is an indication of butterfly relationships (Ae, 1958; Forbes, 1958; Garth and Tilden, 1963:16). Garth and Tilden (1963) cite as an example certain *Colias* species that feed on *Vaccinium* instead of "preferred" legumes and therefore should be set apart from others of their genus. However, there is some evidence that this is a conditional argument. For example, considering morphological characters, *Papilio indra* and its subspecies, strictly Umbelliferae feeders, are not closely related to the *P. machaon* L. species complex which has species that feed on Umbelliferae, Compositae (*Artemisia dracunculus* for *P. bairdii* Edwards), and Rutaceae (*Thamnosma montana* Torr. & Frem. for *P. rudkini* Comstock). Using foodplants here for taxonomic purposes, that would make *P. indra* closer to the *P. machaon* complex than either *P. bairdii* or *P. rudkini* is. The potential of foodplant relations as data for butterfly classification is discussed by Downey (1962).

REPORTING PROCEDURE AND COLLECTING METHODS

To help overcome the mistakes made in the past in reporting foodplants, we wish to establish certain guide-lines to follow. Several such attempts have been made in the past. Remington (1947a) proposed that the Lepidopterists' Society would have a botanist available to determine foodplants; however, the idea apparently did not materialize. Opler (1967), in giving new foodplants for *Anthocaris sara* Lucas and *A. lanceolata* Lucas, confirmed the determinations with a botanist, gave exact locality and date that the plant was collected, gave the circumstances under which the plant was found to be a food source, and even reported the determination down to "varieties" (=subspecies). However, no place of deposition was assigned for the plants or immatures. Remington (1952) deposited foodplants at a designated herbarium.

Foodplants should be determined by a competent botanist and placed on file with a recognized herbarium specifically referred to for later inspection if ever needed. (Herbaria of the world are listed in Lanjouw and Stafleu, 1959, with their proper abbreviations). Some groups of plants must be determined by a specialist. Herbarium records are always mandatory. Certain groups such as *Agave* and *Lupinus* as yet have not been revised satisfactorily. We hope that eventually all North American butterflies will have their foodplants on file in herbaria for future reference.

A plant press should be part of the standard equipment of the lepidopterist concerned with butterfly biology. Flowers and/or fruit are essential for determination of most plant species. In instances where oviposition or immatures occur on plants with no flowers or fruit, leaf characteristics should be carefully compared with surrounding plants (to be used for specimens), and this should be stated when recording the plant. When a female oviposits on a plant species that is not in bloom, it is sometimes necessary to return to the exact spot later in the season or the following year to collect the same plant with flowers or fruit (the plant should be marked). Also, plants that ovipositing females are "interested in" may also be the clue to finding the foodplant; suspected foodplants, properly documented, are valuable to report since they assist in finding new foodplants.

Just as preserving foodplants is a necessity, preservation of the butterfly stage connected with the foodplant is extremely important. Whether it was an ovipositing female or adults ultimately reared from in situ larvae, or eggs, larvae, or pupae compared with known species, the material should be preserved and deposited in a designated museum for later reference by future workers. This is particularly important in case of future revisions and the naming of new subspecies.

Giving the locality of the foodplant is important because different foodplants are often used in different localities, and the same species that serves as a foodplant in one locality may not serve as a foodplant in another locality (Downey, 1962). Vegetation type is important to report. For example, we found *Satyrium fuliginosum* (Edwards) only in sagebrush areas even though its foodplant, a *Lupinus* species, occurred in other habitats. The condition of the foodplant is often important. Frequently species will prefer to oviposit on seedlings of the foodplant or on plants without flowers. *Vanessa virginiensis* (Drury) oviposits on *Gnaphalium* seedlings (Dethier, 1959a) and *Vanessa cardui* will oviposit on small, second growth thistles (Keji, 1951).

Evidence of feeding may be important in determining new localities for a species when no immatures or adults are present. For example, Megathyminae larvae construct "trap doors" and "tents", and *Papilio bairdii* larvae strip *Artemisia dracunculus* stems of leaves and deposit a characteristic type of feces on the ground.

Surprisingly little has been written about methods of locating foodplants of butterflies. Kuzuya (1959) told how to locate theclini eggs in winter in Japan, which helps to locate their foodplants. McFarland (1964) discussed methods of collecting Macrolepidoptera larvae. In the future, it would be helpful to know the location of eggs on the foodplant and what part of the plant the larvae eat, to assist in finding immatures and foodplants. For example, we found *Lycaena* eggs in stem axils and *Euphydryas* egg masses only on the underside of the leaves. Larvae may feed on certain parts exclusively such as young leaves, flowers, or bark. Also, the manner in which the eggs are laid is important (singly, clusters, or small groups).

The behavior of females is often a clue in discovering foodplants. A female repeatedly alighting on the same plant species and curling her abdomen toward the plant should be watched. If the female does not lay eggs on the plant, the plant should be checked anyway for eggs from other females. Certain females such as *Speyeria, Parnassius,* and *Satyrium fuliginosum* do not always oviposit directly on the foodplant, so that choice of food with these is the responsibility of the young larva. *Hesperia lindseyi* Holland oviposits on lichens or some other substrate; the larvae must select the proper grass species (MacNeill, 1964:32). Female oviposition on a plant may not necessarily mean the plant is a foodplant. Examples of "mistakes" by females are well known. Coolidge (1925) found *Hylephila phylaeus* (Drury) ovipositing on grasses, rocks, twigs, and even a paved street. *Speyeria* oviposit on dried leaves (Ritchie, 1944), various plants (Guppy, 1953), and *Artemisia* bark (Durden, 1965), but the larvae eat leaves of *Viola* species. There are examples of butterfly species ovipositing on introduced plants on which the resultant larvae do not survive (Remington, 1952; Brower, 1958b; Brooks, 1962; Straatman, 1962b; Sevastopulo, 1964).

In the genera *Euphydryas, Chlosyne,* and *Phyciodes,* it is sometimes easier to search for larval webs on suspected foodplants in summer or fall after the adults have flown than it is to follow females or to search for eggs. Newcomer (1967) found larvae of *Chlosyne hoffmanni manchada* Bauer on *Aster conspicuus* Lindley by looking for larval webs in July after the adults had flown.

Knowing only one species' foodplant can be useful in locating foodplants for other members of the same genus (e.g., *Speyeria* and *Euphydryas*). Sometimes it may be helpful to locate areas where few possible foodplants are available so that the foodplant can be located easily. For example, *Ochlodes yuma* (Edwards) flies in some areas where its foodplant, *Phragmites communis* Trin., is the only grass present.

In problem groups such as Satyrinae, it may be necessary to place possible foodplants with caged females for clues or to statistically analyze the numbers of young larvae that crawl toward, feed on, and remain on a variety of plant species placed in a petri dish.

Often the areas where females oviposit are away from the flight areas of the males; locating such areas of female concentration increases the probability of finding foodplants. For example, we found an area where *Colias scudderii* Reakirt females were ovipositing on low-growing *Salix* plants in only one small section of a willow bog in Colorado.

Knowing when is the best time to find foodplants can be useful. Langston (1963) states that the appearance of *Eriogonum*-feeding *Philotes* adults is correlated with the early full-bloom of *Eriogonum*. Thus a knowledge of the blooming time in this case helps to locate immatures and their foodplants.

Using a technique suggested by Mr. Christopher Henne (personal communication), we have had success in finding lycaenid larvae in flowerheads by drying out picked flowers of the suspected plant, thus forcing the larvae to crawl up the sides of the container in search of fresh food.

DEPOSITIONS AND DETERMINATIONS

Foodplant records have been recorded intermittently by two of us (JFE and OS) since 1967. The number by the plant is the collector's number (for J. F. Emmel) for the plant. The deposited butterfly material is labelled to include this number. The herbarium sheets with the exception of the Umbelliferae will be deposited with their respective species at the Dudley Herbarium, Stanford University, Stanford, California (DS); the Umbelliferae will be deposited at the U. C. Berkeley Herbarium, Berkeley, California (UC); and the preserved butterfly material will be deposited at the Los Angeles County Museum, Los Angeles, California.

Most of the plants were identified by one of us (DEB). Species of the genus *Eriogonum* were identified by Dr. James L. Reveal, Department of Botany, University of Maryland, College Park, Maryland, and the Umbelliferae were determined by Dr. Lincoln Constance, Department of Botany, University of California, Berkeley, California.

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FOODPLANT RECORDS

(All collected by JFE and OS unless otherwise noted. Plant genera of the world can be placed to family by reference to Willis, 1966.)

PIERIDAE

1. *Colias alexandra* Edwards. Wasatch Plateau, 10,000′, near Mt. Sanpete, E. of Ephraim, Sanpete Co., Utah, 31 July 1967,

female oviposited at 11:30 AM MST on leaf of *Astragalus miser* Dougl. ex Hook. (Leguminosae), *J. F. Emmel 25* (DS).

2. *Colias meadii* Edwards. Cottonwood Pass, 12,200′, Chaffee Co., Colo., 28 July 1967, female oviposited between 8:20-9:30 AM MST on leaf underside of *Trifolium dasyphyllum* Torr. & Gray (Leguminosae), *J. F. Emmel 22* (DS).
3. *Euchloe ausonides coloradensis* (H. Edwards). (A) Dry meadow at 9600′, Gothic, Gunnison Co., Colo., 10 July 1967, female oviposited at 10:00 AM MST on flower bud of *Arabis drummondi* Gray (Cruciferae), *J. F. Emmel 6* (DS). (B) North side of Schofield Pass, 10,400′, Gunnison Co., Colo., 14 July 1967, female oviposited at 2:00 PM MST on flower bud of *Descurainia californica* (Gray) O. E. Schulz (Cruciferae), *J. F. Emmel 11* (DS). (C) Schofield Pass, 10,500′, Gunnison, Co., Colo., 18 July 1967, female oviposited at 1:30 PM MST on flower bud of *Descurainia californica* (Gray) O. E. Schulz (Cruciferae), *J. F. Emmel 13* (DS).
4. *Pieris napi* (Linnaeus). (A) East River at 9600′, in wet meadow among willows, near Gothic, Gunnison Co., Colo., 10 July 1967, female oviposited at 10:00 AM MST on leaf underside of *Cardamine cordifolia* A. Gray (Cruciferae), *J. F. Emmel 7* (DS). (B) Meadow ½ mile S. Brush Creek Cow Camp, 9000′ near the East River, Gunnison Co., Colo., 12 July 1967, female oviposited at 10:00 AM MST on leaf underside of *Thlaspi arvense* L. (Cruciferae), *J. F. Emmel 10* (DS). (C) Cement Creek, Gunnison Co., Colo., 18 July 1967, female oviposited at 2:00 PM MST on leaf underside of *Thlaspi arvense* L. (Cruciferae), *J. F. Emmel 14* (DS).
5. *Pieris occidentalis* Reakirt. (A) East slope of Belleview Mountain, 11,700′, near Schofield Pass, Gunnison Co., Colo., 25 July 1967, female oviposited at 11:30 AM MST on leaf underside of *Thlaspi alpestre* L. (Cruciferae), *J. F. Emmel 21* (DS). (B) Rockslide above Island Lake, 10,500′, Ruby Mts., Elko Co., Nev., 8 Aug. 1967 (collectors JFE, OS, and S. Ellis), female oviposited at 10:15 AM PST on leaf underside of *Draba cuneifolia* Nutt .ex T. &. G. (Cruciferae), *J. F. Emmel 32* (DS).

NYMPHALIDAE

1. *Chlosyne acastus* Edwards. In washes along road, 9 miles W. of Vernal on U.S. Hwy. 40, Uintah Co., Utah, 21 Aug. 1967 (collectors JFE, OS, and S. Ellis), two larvae on plant stems, pair reared to adult (emerged 22 Feb. 1968, male; 21 Feb. 1968, female), on *Machaeranthera viscosa* (Nutt.) Greene

(Compositae), *J. F. Emmel 39* (DS).

2. *Chlosyne palla calydon* Strecker. On grassy slope with aspen, sagebrush, and *Castilleja,* near Brush Creek Cow Camp above the East River, 9100′, Gunnison Co., Colo., 27 Aug. 1967, larva in web near base of stems (adult formed inside pupa, a male; genitalia identical to *C. palla* from Colorado in the Los Angeles County Museum and to the drawing in Ehrlich and Ehrlich, 1961), on *Erigeron speciosus* (Lindl.) DC (Compositae), *J. F. Emmel 41* (DS).
3. *Polygonia zephyrus* (Edwards) Charleston Park, 8300′, Charleston Mts., Clark Co., Nev., 31 Aug. 1967, larva on stem (male emerged 16 Sept. 1967) of *Ribes cereum* Dougl. (Saxifragaceae), *J. F. Emmel 45* (DS).
4. *Speyeria atlantis dodgei* (Gunder). Lost Prairie, W. of Santiam Pass on U.S. Hwy. 20, Linn Co., Ore., 12 Aug. 1967 (collectors JFE, OS, and S. Ellis), female oviposited on leaf underside (female reared from this female, emerged 6 Apr. 1968) of *Viola bellidifolia* Greene (Violaceae), *J. F. Emmel 36* (DS).

LYCAENIDAE

1. *Glaucopsyche lygdamus oro* Scudder. Large, open, dry meadow, north side of Schofield Pass, 10,400′, Gunnison Co., Colo., 14 July 1967, female oviposited at 1:45 PM MST on flower bud of *Lupinus ammophilus* Greene (Leguminosae), *J. F. Emmel 12* (DS).
2. *Plebejus argyrognomen ricei* (Cross). (A) Lost Prairie, W. of Santiam Pass, on U.S. Hwy. 20, Linn Co., Ore., 12 Aug. 1967 (collectors JFE, OS, and S. Ellis), female oviposited at 12:15 PM PST on stem near base of plant of *Vicia exigua* Nutt. (Leguminosae), *J. F. Emmel 38* (DS). (B) Lost Prairie, W. of Santiam Pass, on U.S. Hwy. 20, Linn Co., Ore., 12 Aug. 1967 (collectors JFE, OS and S. Ellis), female oviposited at 12:30 PM PST on stem near base of plant of *Lathyrus torreyi* Gray (Leguminosae), *J. F. Emmel 37* (DS).
3. *Plebejus saepiolus* (Boisduval). (A) Crested Butte Cemetery, 8900′, Crested Butte, Gunnison Co., Colo., 12 July 1967, female oviposted inside flower-head between flowers of *Trifolium repens* L. (Leguminosae), *J. F. Emmel 8* (DS). (B) Crested Butte Cemetery, 8900′, Crested Butte, Gunnison Co., Colo., 12 July 1967, female oviposited inside flower-head between flowers of *Trifolium longipes* Nutt. (Leguminosae), *J. F. Emmel 9* (DS). (C) Trail from Pine Creek Camp to Mt. Jefferson, 10,500′, Toquima Range, Nye Co., Nev., 4 Aug.

1967 (collectors JFE and S. Ellis), female oviposited at 1:00 PM PST on side of flower of *Trifolium monanthum* Gray (Leguminosae), *J. F. Emmel 29* (DS).

HESPERIIDAE

1. *Hesperia uncas* Edwards. Hilltop 2 miles S. of Gunnison, 8000′, Gunnison Co., Colo., 27 Aug. 1967, female oviposited at 11:10 AM MST on leaf underside of *Bouteloua gracilis* (HBK.) Lag. (Gramineae), *J. F. Emmel 42* (DS).
2. *Thorybes mexicana nevada* Scudder. Open dry meadow near Crested Butte Cemetery, 8900′, Crested Butte, Gunnison Co., Colo., 30 June 1967, female oviposited at 10:55 AM MST on leaf underside of *Lathyrus leucanthus* Rydb. (Leguminosae), *J. F. Emmel 2* (DS).

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