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BUTTERFLIES of Grand Canyon National Park

JOHN S. GARTH

GRAND CANYON NATURAL HISTORY ASSOCIATION
GRAND CANYON, ARIZONA

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Grand Canyon National Park

ARIZONA

Harold C. Bryant
Superintendent

Louis Schellbach, III
Park Naturalist

Our friends will notice the new make-up of this bulletin. Number eleven, beginning a new run of ten numbers, seemed a logical break for our having the bulletins typeset and illustrated with line cuts, half-tones and color plates, when possible. It is hoped the expense will not be too great for us to continue this type of format.

We express our appreciation and gratitude to Dr. John S. Garth for his painstaking research and work in preparing this manuscript for publication. It makes a valued contribution in our series of publications dealing with Grand Canyon National Park. In no less degree we mention Captain Allan Hancock, Director of the Allan Hancock Foundation, for his splendid and unselfish cooperation.

These bulletins are published at irregular intervals as material and manuscripts are made available, and when earlier bulletins need revision due to the accumulation of new and pertinent facts.

The Association is a nonprofit organization whose policy is to stimulate interest in the natural sciences and historical resources of Grand Canyon National Park, to encourage scientific research and to establish and maintain a reference library for visitors, students and park personnel.

Louis Schellbach,
Editor and Executive Secretary.

Cover Illustration

Three Southwest Desert butterflies found in association with Live Oak. Clockwise from the upper left: BOISDUVAL'S HAIR-STREAK (*Habrodais grunus*), THE COLORADO HAIR-STREAK (*Hypaurotis chrysalus*), and THE ARIZONA SISTER (*Heterochroa bredowii eulalia*).

BUTTERFLIES OF GRAND CANYON NATIONAL PARK

By

JOHN S. GARTH

Allan Hancock Foundation

The University of Southern California

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Grand Canyon, Arizona

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Fig. 1. Tonto Plateau and Inner Gorge, Grand Canyon, looking west from top of Redwall, Yaki Trail. Lower Sonoran Life Zone.—National Park Service Photo.

BUTTERFLIES OF GRAND CANYON NATIONAL PARK[1]

By JOHN S. GARTH

Introduction

Since the 1,009 square miles which comprise Grand Canyon National Park contain a wide variety of topographic and climatic conditions, the pursuit of any phase of natural history within its confines should be correspondingly rewarding. A series of check lists of mammals, birds, reptiles and amphibians, and plants of the area, published successively by the Grand Canyon Natural History Association, has abundantly demonstrated the correctness of this assertion. The need for a check list of the butterflies has likewise been apparent, since of all the insects these day fliers flaunt their colors most conspicuously before the park visitor. However, the necessary preoccupation of the naturalist staff with the geology, flora, and vertebrate fauna of the park, including prehistoric man, has so far prevented its realization.

The writer first became acquainted with the possibilities for butterfly collecting at the Grand Canyon in 1936 while on a brief reconnaissance which included both North and South Rims. Not until 1942 was it possible to return for intensive collecting. In that year a party of four from the Allan Hancock Foundation of the University of Southern California, under permit from the National Park Service, spent ten days, June 1-10, collecting at the South Rim, including the Hermit Basin. After wartime interruptions which saw the original group disbanded, the writer returned at the invitation of the Grand Canyon Natural History Association to spend a similar period, August 12-22, 1946, at the North Rim. Subsequently, a second party of four from the Allan Hancock Foundation spent nearly three weeks, July 3-19, 1947, at the North Rim, including a five day exploration of Muav Saddle and Powell Plateau. Finally, it was the writer's privilege to spend four days, March 23-26, 1948, in the vicinity of Phantom Ranch. In all, the South Rim was explored for butterflies from Havasupai Point on the west to Grandview Point on the east, the North Rim from

[1]Contribution of the Allan Hancock Foundation. 46

Dutton Point on the west to Cape Royal on the east, including Roaring Spring Canyon, and a transect of the Grand Canyon was run along the Kaibab Trail at the level of Bright Angel Creek.

It is as a latter day study based upon fresh materials, rather than as a review of the work of pioneer collectors and original specimens, that the present survey was attempted. No search of the literature was made to determine the first published record of a Grand Canyon butterfly. Early collectors there undoubtedly were whose specimens, if extant, lie buried in the great collections of eastern North America and Europe from which it would be a time consuming task to exhume them. How much more exhilarating to take net in hand and proceed as if one were the first lepidopterist, instead of merely the latest, to tread Bright Angel Trail or to ascend the Throne of Wotan! For those of our calling who live by the Law of Priority and who pay homage to the twin dieties of Type Specimen and Type Locality, the Grand Canyon presents a particular challenge, for so far removed was it from the classic western localities of a century ago, such as Virginia City, Nevada, that specimens collected in this but lately accessible corner of Arizona are more often intermediate between known races of a given species than typical of any one of them.

The writer has in his possession a list of nine species collected "along the Plateau near Hotel El Tovar" by J. R. Haskin on June 5, 1910, which, allowing for differences in nomenclature, includes *Neonympha dorothea*, *Coenonympha furcae*, *Eumenis dionysus*, *Melitaea arachne*, and *Heterochroa eulalia*. As for collectors of comparatively recent date, both Dr. W. J. Holland and Dr. J. A. Comstock, whose books on butterflies are familiar to every student, are known to have visited the Grand Canyon in the 1920's. In 1934 Dr. F. E. Lutz and Mr. E. L. Bell of the American Museum of Natural History made the first of several excursions into the lower reaches of the canyon, leaving duplicates of specimens collected with the park naturalist, and to them we are indebted for records from Havasu Canyon, Indian Gardens, and Phantom Ranch. Recognizing the possibilities of a small research collection to be housed in the Naturalist Workshop, park naturalist Louis Schellbach III gave personal attention to the collecting and preserving of Lepidoptera, and through his efforts and those of park superintendent Dr. H. C. Bryant, many species have been added to the butterfly fauna of the park. Others who contributed, their dates and collecting localities, are given on page 44. The result is that no longer need one go to New York, Philadelphia, or Washington to see Grand Canyon

butterflies: they are available locally to help identify a specimen, or merely to acquaint the interested visitor with the butterflies of the park.

It is believed that the list which follows avoids to a considerable extent the criticisms which are often applied to similar enumerations of local insect populations; namely, that they are based upon too little collecting, that they fail to take into account seasonal and cyclic changes, and that they represent the opinion of but a single observer. As to the first two, collecting has been carried on by some 25 individuals, who have made collections in the park in every month of the year from February to October, inclusive. No one year's records have been used to the exclusion of others, although 1942, 1946, and 1947, because of the activities of Allan Hancock Foundation survey parties, are perhaps more frequently represented. And as for the last, the amount of collecting done by park naturalist Louis Schellbach, beginning in 1938, and the numerous determinations made on his specimens by U. S. National Museum and Los Angeles County Museum scientists, speak for themselves in later pages. Considering the size of the area treated, which is smaller than our smallest state, Rhode Island, the 103 full species of butterflies encountered in Grand Canyon National Park compares more than favorably with the 236 recorded by Comstock in 1927 for California, the 241 recorded by Cross in 1937 for Colorado, or the 692 listed by McDunnough in 1938 for North America north of Mexico.

While the work which has been done to date constitutes considerably more than a random sampling, there remain vast areas within Grand Canyon National Park about which little or nothing is known entomologically. Included are the northward-jutting plateau known as "The Thumb," accessible by road from Hilltop, and Clear Creek, to which a good trail has been built from Phantom Ranch, the *Ultima Thule* of previous collectors. More difficult of access are Nankoweap Basin, stretching eastward from Point Imperial, and Shinumo Creek, which lies across the Colorado River from Bass Canyon. The Tonto Plateau has been tapped by sporadic collecting at Indian Gardens only, whereas the Tonto Trail extends at this median elevation from Garnet Canyon on the west to Red Canyon on the east, an airline distance of 32 miles. Thus, while the Grand Canyon has yielded much to a limited investigation, some of the most promising territory is yet to be explored. It may be safely predicted, however, that the most remote of the canyon's recesses will long remain virgin, a challenge to lepidopterists of future generations.

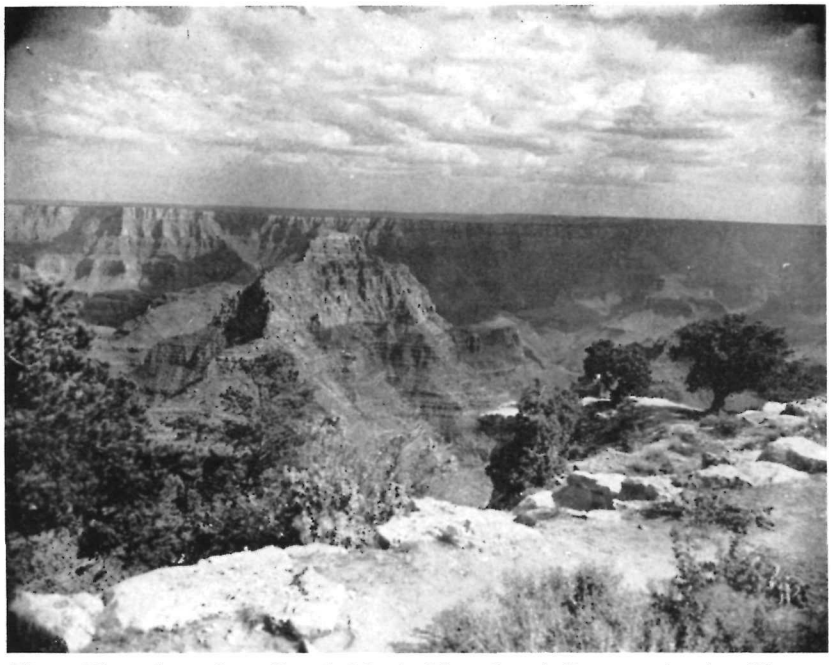

Fig. 2. View from Cape Royal, North Rim, Grand Canyon, showing Pinyon Pine and Buffalo Berry growing below rim trail. Upper Sonoran Life Zone. —Photo by Schellbach.

Life Zones

It is not intended here to enter into a detailed discussion of Life Zones as they exist in the Grand Canyon. For such information the reader is referred to one of the earlier manuals of this series.[2] Suffice it to say that within the greater Grand Canyon region, which includes the San Francisco Peaks to the south, there are represented all but one of the seven Life Zones found in North America, the missing zone being the Subtropical, found in the United States only in southern Florida. Beginning with the lowest and ascending in order we have the Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian, and Arctic-Alpine Zone, each with its characteristic assemblage of plants and animals. In an earlier paper[3] the writer attempted to give

[2]Dodge: Trees of Grand Canyon National Park, pp. 4-7, 1936.

[3]Garth: Butterflies of Yosemite National Park, Bull. S. Calif. Acad. Sci., 34:37-75, 1935.

the Life Zone in which each butterfly most frequently occurred. This was relatively simple on the west slope of the Sierra Nevada, where the gentle gradient permits the full development of each zone in regular succession with a minimum of deviation from the customary temperature-altitude relationship. In the Grand Canyon region, however, several special conditions are met which, unless properly understood, will cause even the firmest believer in Life Zone principles to question the validity of his precepts. These will be considered briefly.

Zonal Suppression: The fir and spruce forests of North Rim Canadian Zone extend to within a few feet of the edge of the canyon, where they are met by Upper Sonoran pinyon and juniper growing on the canyon wall. The yellow pines of Transition are seldom present between them, for Transition Zone has been suppressed over much of the North Rim. It is present in extensive areas only on the finger-like points, such as Tiyo and Sublime, or the interrupted plateaus, such as Walhalla and Powell, which extend many miles into the canyon and which drop below the critical level for Canadian Zone while the slope remains gradual.

Fig. 3. Ponderosa pine community, South Rim, Grand Canyon. Transition Life Zone.—Photo by Schellbach.

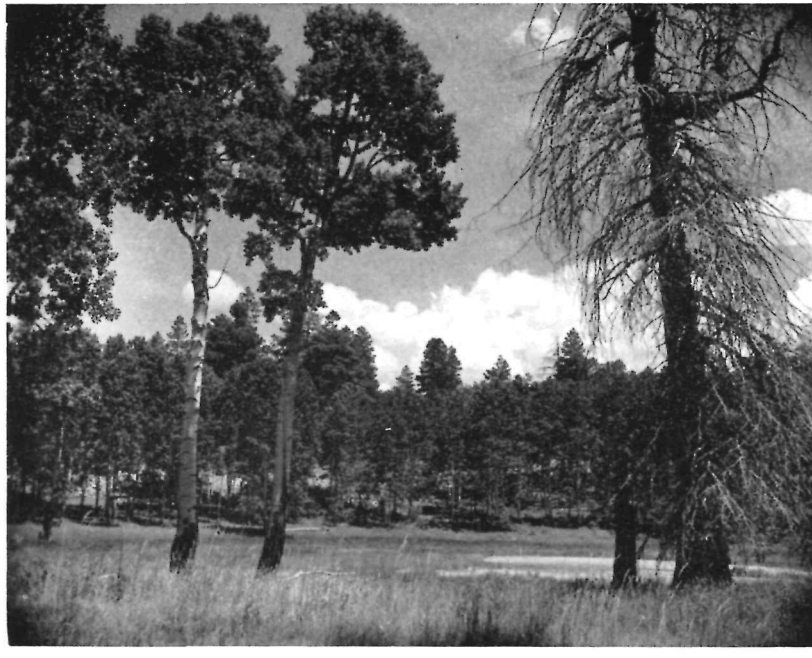

Fig. 4. Greenland Lake, North Rim, Grand Canyon. The white-barked trees are Quaking Aspen. Canadian Life Zone. Meadow association.
—Photo by Schellbach.

It is apparent that it is largely the Transition Zone areas of the Kaibab Plateau which have fallen victim to the erosive northward advance of the Grand Canyon. Continuous exposure of the north wall to the desert sun and currents of hot air arising from the canyon bottom favor the development there of an Upper Sonoran flora. The result, insofar as it affects the butterflies with their natural tendency to fly upward, is that Upper Sonoran species mingle with Canadian species along the narrow marginal strip of the canyon's North Rim, and one not fortified by knowledge gained elsewhere might be led to most unreliable conclusions concerning their normal habitat.

Zonal Inversion: The yellow pine forests of the higher portions of the South Rim also extend to the edge of the canyon. Here, however, they are met by Douglas fir trees which grow on a ledge 100-150 feet below. The situation at the North Rim is inverted, Canadian Zone occurring below Transition, instead of above. Again, it is the opposite of North Rim conditions, namely, perpetual shade allowing a heavy

accumulation of snowfall, plus possible downdrafts of cooler air, which brings about this anomalous situation, these factors locally transcending the effect of altitude.

Zonal Elements Weakly Represented: This situation is by no means peculiar to the Grand Canyon, but is found wherever there is insufficient territory suitable to permit full development of a characteristic zonal flora and fauna. Canadian Zone is weakly represented on the South Rim by the narrow band of Douglas fir trees mentioned above, and by a grove of aspen trees located 16 miles east of Grand Canyon Village. Does this constitute bona fide Canadian Zone? The single Canadian Zone butterfly collected there, *Thorybes pylades,* is scarcely sufficient evidence for an affirmative answer, nor is the area large enough to support a characteristic mammalian population. Again, Transition Zone may be considered weakly represented at Muav Saddle, where yellow pines occupy the depression between Swamp Point and Powell Plateau. *Neophasia menapia,* a Transition species, was observed there, but the preponderant number of species were Upper Sonoran fliers which use the low divide as a migratory pathway. Finally, Hudsonian Zone is weakly represented at Checking Station Meadow, where blue gentians and alpine fir are found, but where no butterfly occurs which is not also at home in the lower, Canadian Zone territory.

Food Plants

In the final analysis, the Life Zone or smaller ecological subdivision tenanted by a butterfly depends upon the growth habits of its food plant, and these are in turn dependent upon such considerations as exposure, rainfall, soil depth and mineral content. In order to determine the food plant of choice, which differs from species to species, it is necessary to observe the laying of the egg by the female, to find the caterpillar in the act of feeding, or to experiment with a number of plants until one is found which is acceptable to it. Work of this type requires patient, year-around attention and a laboratory equipped for insect rearing, both of which are beyond the scope of this preliminary survey.

Fortunately for the entomologist, an excellent manual, "Plants of Grand Canyon National Park," by W. B. McDougall, is available as an earlier issue in this series. In it may be found not only which plants occur in the region, but the exact localities at which these plants are found. These supplementary records will often suggest additional localities at which the butterfly known to feed upon a particular plant

may be sought with profit. Due to the energy with which J. A. Comstock, C. M. Dammers, and others have pursued life history studies of California butterflies, the early stages of many southwestern desert and mountain species are known. Such information may be applied directly to the local situation whenever both the butterfly and the species or variety of plant on which it has been successfully reared are known to occur within Grand Canyon territory.

In a number of cases it is the race of the Sierra Nevada, rather than that of the Rocky Mountains, which has been studied in detail, and the food plant so determined is not known to occur locally. Here it must be assumed that a closely related plant, in all probability a member of the same genus, is utilized by the butterfly race which occurs in the Grand Canyon region. In a very few instances, neither the species of plant, nor any member of its genus is represented in the park flora, and closely related genera of plants, in all probability members of the same family, must be suspected of nurturing the butterfly in this vicinity. By such reasoning, coupled with use of the plant manual, it has been possible to list a probable, if not an actual, Grand Canyon food plant for each species of which the life history is known. Only eventual rearing under laboratory conditions of the Grand Canyon race will prove whether the assumed host plant is the actual one.

Acknowledgment

The writer wishes to acknowledge his indebtedness to Dr. Harold C. Bryant, park superintendent, and Mr. Louis Schellbach, III, park naturalist, for courtesies extended to field parties of the Allan Hancock Foundation of which he was a member; to the Grand Canyon Natural History Association for a grant in aid while making an independent preliminary survey of the North Rim; and to Captain Allan Hancock, director of the Foundation, for the personal interest taken in the survey. Among professional colleagues in the entomological field he is indebted to Mr. J. F. Gates Clark, Mr. W. D. Field, and Dr. Carl Heinrich of the U. S. National Museum for identifications of Grand Canyon butterflies made for the park naturalist, and to Dr. Charles D. Michener for obtaining data on specimens collected in the Grand Canyon from the American Museum of Natural History. Lastly, he is under obligation to Dr. John A. Comstock and Mr. Lloyd M. Martin for assistance in critical determinations, for providing information on life history studies, and for opening to him the reference collection of the Los Angeles County Museum.

Annotated Check List

The list which follows has been prepared in accordance with "Check List of the Lepidoptera of Canada and the United States of America," by J. McDunnough (Mem. So. Calif. Acad. Sci., vol. 1, 1938). The original numbering of species and lettering of races has been preserved with the exception of those subsequently described or raised from synonymy. Such species have been placed next the listed species to which they are believed most closely related and given the same number followed by a decimal; for example, 99.1 *Neonympha dorothea.* Such races have been given the next unassigned letter; for example, 326b *Heterochroa bredowii eulalia.*

The scientific name of the insect is followed by one or more specific records of its capture obtained from specimens in the Naturalist Workshop or in the collection of the Allan Hancock Foundation.[4] Since some historical interest is attached to the first capture of an insect within the Park, early records have been scrupulously preserved, although the data associated with the specimen are frequently meager when judged by standards set for later phases of the study. Exact locality, date, and collector's name are given when known. An attempt has been made to include records from both North and South Rims, from the widest possible range of altitude, and of the earliest and latest dates at which the butterfly is known to be on the wing. A complete listing of localities and collectors will be found immediately following this section. Uncredited supplementary and sight records are the author's.

The common name of the butterfly, as given by J. A. Comstock in "Butterflies of California" (1927) or by W. J. Holland in "The Butterfly Book" (revised edition, 1930), is incorporated into an explanatory paragraph. Particular attention is paid to the distribution of the insect within the Park, its range beyond the confines of the Grand Canyon region, the peculiarities which distinguish park individuals from those taken elsewhere, if any, and those salient features which separate it from related species. One or more actual or probable food plants are listed for each species of which the early stages are known, but no attempt is made to describe the egg, larva, or pupa. The writer departs from the custom of giving a life zone citation for each species, as data

[4] In a few cases in the collection of the American Museum of Natural History, New York.

on many fliers in Grand Canyon National Park are still too fragmentary to permit this with any degree of certainty.

Illustrations are of specimens collected in Grand Canyon National Park in the course of this survey. Species chosen for illustrative purposes are those believed to be most characteristic of the region. All figures are natural size unless otherwise noted. Photographs not otherwise credited were taken at the Allan Hancock Foundation.

PAPILIONIDAE (THE SWALLOWTAILS)

1. *Papilio philenor* L. (Village 29-vii-46 Schellbach; Sublime 22-viii-46 Garth; Indian Gardens 9-ix-46 Sturm; sight record: Phantom 24-iii-48)

THE PIPE-VINE SWALLOWTAIL ranges from Massachusetts to Arizona and Southern California, being replaced in northern Mexico by the short-tailed race, *acauda* Oberth. It flies at various levels within the Park, from Phantom Ranch to Point Sublime. The caterpillar feeds on *Aristolochia*, or Dutchman's Pipe.

4. *Papilio ajax* L. (N. Rim 3-viii-38 Schellbach)

A single specimen of THE COMMON AMERICAN SWALLOWTAIL, determined by J. F. Gates Clark of the U. S. National Museum as *Papilio polyxenes asterius* Cram., is contained in the Naturalist Workshop collection. The apparent confusion in the scientific name results from the fact that McDunnough, whose 1938 Check List is followed here, considers *asterius* Cram. a synonym of *ajax* L. The specimen in question is believed by the writer to be identical with 10b. below.

6. *Papilio bairdii* Edw. (Village 20-v-32 Williamson; N. Rim 19-vii-42 Bryant; Shoshone 28-v-44 Schellbach; Neal 16-viii-46 Garth; also Hearst, Yavapai, and Narrows)

BAIRD'S SWALLOWTAIL was thought for a time to fly only on the South Rim, the black females having been seen hovering over such promontories as Hopi, Yaki, and Shoshone Points, or flying through yellow pine forests immediately behind them. Now, however, it may be reported from the North Rim as well, having been found at Lower Neal Spring and at the Narrows separating Walhalla Plateau from the North Rim proper. These localities show strong Upper Sonoran infiltration.

b. *hollandi* Edw., form *brucei* Edw. (N. Rim 3-vi-39 Schellbach)

BRUCE'S SWALLOWTAIL, the Utah-Colorado form of this high-

ly polymorphic species, is an early season flier at the North Rim. It is also found in the desert valleys of eastern central California, in Mono and Inyo Counties. Like the parent species, it feeds on wild parsley (Umbelliferae).

c. *rudkini* Comst. N. Rim 9-ix-41 Schellbach; Sublime 9-viii-42 Schellbach; N. Rim 18-vii-47 Tinkham)

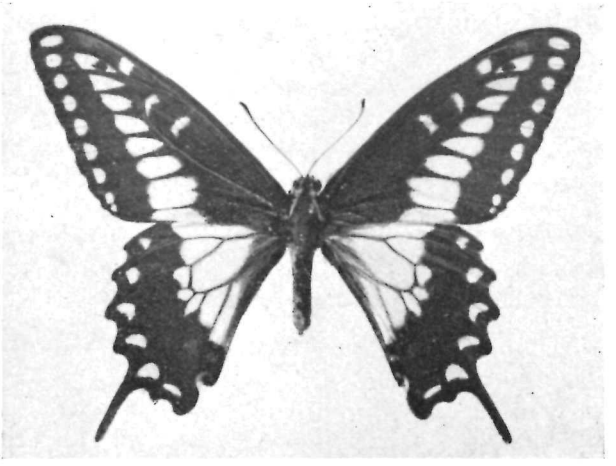

Fig. 5. *Papilio bairdii rudkini,* male.

RUDKIN'S SWALLOWTAIL occurs typically in the Ivanpah Mountains of California, which lie across the Colorado River from Kingman, Arizona. Thus it has easy access to the Grand Canyon via the Colorado River valley. The Point Sublime specimen listed above was determined by J. A. Comstock, author of the subspecies. The specimen netted by E. R. Tinkham at North Rim Headquarters proved to be form *clarki* Chermock. The larvae feed on Turpentine Broom (*Thamnosma montana*), common in the lower elevations of the Park.

10b. *Papilio indra minori* Cross (Yavapai 22-viii-44 Schellbach; Royal 18-viii-46 Garth)

MINOR'S SWALLOWTAIL is a Colorado race of the Short Tailed Swallowtail which belies the name of the parent species, having a tail of unusual length. The writer is indebted to Lloyd Martin of the Los Angeles Museum for pointing out the similarity of the under wing of this *Papilio* to *indra* rather than to *bairdii.* Because of the presence on the Kaibab-Coconino Plateau of nearly two dozen other Rocky Mountain races of butterfly, this third black swallowtail of the Park (the

others being *P. philenor* and *P. bairdii*) is referred to *minori* without hesitation, although specimens of the latter, a great rarity in collections, have not been available for comparison. The food plant is wild parsley.

16. *Papilio rutulus* Luc. (N. Rim 8-vi to 10-vii-38 Schellbach; sight records: Hermit 4-vi-42; Neal 4-vii-47)

THE WESTERN TIGER SWALLOWTAIL occurs at the North Rim in June and July, a long series taken by the park naturalist having been determined by J. F. G. Clark. Included is an aberrant form in which the primaries are rounded and a totally black secondary "cell" is formed by the broadening of the outer marking. A willow and alder feeder, *rutulus* follows the watercourses. It is possible that South Rim specimens may prove to be race *arizonensis* Edw.

17. *Papilio daunus* Bdv. (Supai 2-viii-31 Rockefeller; S. Rim 7-viii-34 Tillotson; B. A. Trail 29-vii-47 Arnberger; sight records: Hermit, Bass, Powell, Muav, and Roaring Springs)

THE DAUNUS SWALLOWTAIL is at home in the hot, dry canyons tributary to the main canyon of the Colorado, such as Havasu, Shinumo, and Bright Angel. It is the largest butterfly, and the only two-tailed swallowtail, in the Park. Because of its habit of rapid flight, *daunus* is more often seen than captured, and for this reason the writer's sight records are listed above. Food plants are ash, willow, and rose.

PIERIDAE (THE WHITES AND THEIR ALLIES)

34b. *Anthocharis sara inghami* Gund. (Phantom 27-ii-45 Bryant; Village 18-iv-47 Schellbach; Indian Gardens 26-iii-48 Garth)

Fig. 6. *Anthocharis sara inghami*, female.

INGHAM'S ORANGE-TIP was first taken at Phantom Ranch in late February by park superintendent H. C. Bryant, at Indian Gardens

in late March by the writer, then on the South Rim by park naturalist L. Schellbach in mid-April. Since the orange-tips are early fliers, these dates herald the arrival of spring and emphasize the six weeks' to two months' difference in season between the canyon bottom and South Rim. Wild radishes and mustards are food plants of the orange-tips, that of the nearly related *A. sara reakirti* Bdv. being *Thysanocarpus.*

41. *Colias eurytheme* Bdv. (N. Rim 14-vi-38 Schellbach; Yavapai 3-vi-42 Garth; also Bass, Neal, Kanabownits, Robbers Roost, and Powell)

BOISDUVAL'S SULPHUR occurs on both rims in June and at the North Rim in early July. Associated with alfalfa under cultivation, this butterfly feeds in the wild state upon a variety of leguminous plants, among them *Lotus.* An atypical early-season form was found in Bright Angel Canyon in late March, 1948, by the writer.

form *amphidusa* Bdv. (N. Rim 7-vii-40 Schellbach; Neal 18-vii-47 Garth)

THE FLAVID SULPHUR, so called because of the deepening of the yellow tint to orange, is the summer brood of the species. It flies at the South Rim from early July and at the North Rim from mid-July to late September. Each form has its albinic female, and both are represented in the Naturalist Workshop collection.

55. *Zerene caesonia* Stoll. (Yavapai 22-viii-44 Schellbach)

THE SOUTHERN DOG-FACE, so called because the profile of a dog appears on each fore-wing, is a butterfly of the Gulf States which crosses Arizona into Riverside County, California, where a second species, Z. *eurydice* Bdv., occurs in the higher mountains. Both species feed on Indigo Bush (*Amorpha*), which is represented in the Park flora by *A. fruticosa occidentalis.*

57. *Phoebis sennae* L. (Village 3-ix-46 Arnberger; sight record: Royal 21-viii-46)

THE SENNA SULPHUR has been taken but once in the Park, at Yavapai Station, but it has also been seen by the writer at Cape Royal in August under conditions which did not permit its capture. Male and female differ in a manner common to sulphurs generally. The larval food plant is *Cassia.*

67. *Eurema nicippe* Cram. (Phantom 16-vi-30 collector unknown; Phantom 27-vii-34 Bell; sight record: Phantom 25-iii-48)

THE NICIPPE YELLOW flies in the canyon bottom, where a male was taken in mid-June, a female in late July, both at Phantom Ranch. Food plants are *Cassia* and other Leguminosae. The species ranges southward to Brazil.

69. *Eurema mexicana* Bdv. (S. Rim 23-vi-31 collector unknown)

THE MEXICAN YELLOW is apparently a straggler within the confines of Grand Canyon National Park. A single specimen labeled "*Neonympha henshawi*, South Rim, vi-11-31" was found in the Naturalist Workshop collection. The series of *N. henshawi* (or *dorothea*, as the Park species is now called) yielded a specimen labeled "*E. mexicana*, South Rim, vi-23-31." A simple switch of labels is assumed, and the late June date, rather than the earlier, is considered the correct one for *mexicana*. The pointed hind wings and creamy color serve to distinguish it from the foregoing species.

75. *Nathalis iole* Bdv. (Kanabownits 8-vii-47 Garth; Village 7 and 25-vi-49 Schellbach; also Neal and Swamp Lake)

THE DWARF YELLOW was encountered flying along the single-track wagon road that leads from Kanabownits Spring to Tipover Spring, North Rim, at an elevation of approximately 8,000 feet. The writer had last taken it in southern Florida, at sea level. This diminutive and fragile insect transcends zonal and faunal limitations to become one of the most widely distributed butterflies of North America. Food plants are marigold, filaree, and sneezeweed.

76. *Neophasia menapia* F. & F. (N. Rim 8-viii-46 Bryant; sight record: Muav 15-vii-47)

That THE PINE WHITE may be counted among the butterflies of Grand Canyon National Park is due to the acumen of its superintendent, H. C. Bryant, who recognized this high flying and gregarious species near a C.C.C. camp on the extreme north boundary and waited patiently until one flew within range of his broad-brimmed ranger's hat. In company with Dr. Bryant the writer has had the good fortune of seeing, but not of capturing, this butterfly among the yellow pines of Muav Saddle. It is a late July and August flier. The larvae feed on various species of conifers, notably *Pinus ponderosa*.

79. *Pieris beckerii* Edw. (Phantom 28-vii-34 Bell)

BECKER'S WHITE is the only one of the whites with green on the under side. It occurs in Oregon and California east of the Sierra-Cascades, as well as in Colorado, always in association with a desert

environment. Food plants are Bladder-pod (*Isomeris*) and others.

80. *Pieris sisymbrii* Bdv. (S. Rim 7-v-42 Schellbach; Yavapai 3-vi-42 Garth; sight record: Phantom 24-iii-48)

THE CALIFORNIA WHITE is one of the first butterflies to appear in the spring, having been seen by the writer in Bright Angel Canyon above Phantom Ranch in late March. Double brooded, it may be taken in late summer also. The under wings are gray banded instead of green, as in the foregoing species. Like the other whites, its food plants are members of the mustard family.

81. *Pieris occidentalis* Reak. (S. Rim 12-vi-30 and 20-vi-31 collectors unknown)

THE WESTERN WHITE ranges widely throughout the mountain states from Alaska to Mexico. In his "Butterflies of California" Comstock considered it a subspecies of the following *P. protodice*, which it greatly resembles. In addition to the above specimens, the Naturalist Workship collection includes two heavily marked females without data.

82. *Pieris protodice* Bdv. & Lec. (N. Rim 26-iv-39 and 23-vi-40 Schellbach; Bass 6-vi-42 Garth)

THE COMMON WHITE flies normally at the South Rim from early June and at the North Rim from late June until the end of the summer. The dwarf specimen taken at the North Rim in late April by park naturalist Schellbach represents an exceptionally early record for this elevation. A cabbage feeder, the Common White accepts as food plant many other members of the Cruciferae as well.

DANAIDAE (THE MILKWEED BUTTERFLIES)

89. *Danaus plexippus* L. (Supai 3-viii-34 Rockefeller; N. Rim 17-viii-38 Schellbach; S. Rim 3-viii-42 Schellbach)

THE MONARCH is one of the best known butterflies and the only truly migratory species in North America. In the fall of each year tens of thousands congregate along the California coast for the flight southward. There is no corresponding mass movement northward, the butterflies returning singly and spreading inland in the spring. Grand Canyon records are for the month of August. A milkweed feeder, the Monarch is attracted as an adult to thistles, on which it was photographed at the North Rim. An aberrant specimen, *fumosus* Hlst., without accompanying data, is in the Naturalist Workshop collection.

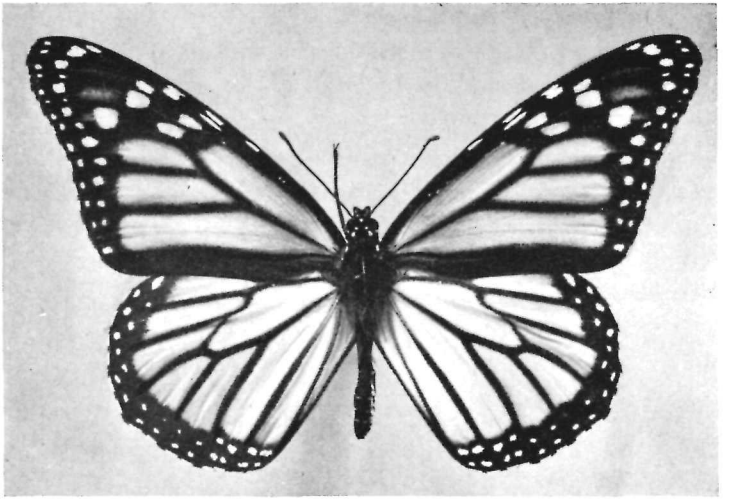

Fig. 7. *Danaus plexippus*, female.

90a. *Danaus berenice strigosa* Bates (Village 16-vi-40 Cox; S. Rim 5-vii-42 Bryant; sight records: Yavapai, Tipover)

THE STRIATED QUEEN, like the Monarch, is a protected species, possessing an acrid fluid which circulates through its veins. It is mimicked in this portion of its range by *Basilarchia obsoleta*, which thus shares its immunity from predatory attack. The sight records above are for June on the South Rim and July on the North. The larval food plant is milkweed (*Asclepias* species and *Funastrum heterophyllum*).

SATYRIDAE (THE SATYRS)

99.1 *Neonympha dorothea dorothea* Nab. (Village 2-vi-31 collector unknown; B. A. Trail 9-vi-41 Nabokov [paratype]; Hermit 4-vi-42 Garth; also Havasupai, Bass, Yavapai, Roaring Springs, and Royal)

THE GRAND CANYON BROWN is the local representative of a more widely distributed butterfly formerly known as Henshaw's Brown, *N. henshawi* Edw., which Vladimir Nabokov (*Psyche*, 49:61-80, 1942) has divided into several species, reserving the designation *henshawi* for the insect as it occurs in southeastern Arizona. As if to compensate for its elusiveness, *dorothea* flies abundantly in favored localities, which are the juniper and pinyon shaded ravines of the canyon's almost vertical walls. The best way to collect it is to station

oneself at a point at which the level trail intersects a gully and wait for the insect to fly either up or down. According to the writer's experience, most of the early June brood are males, some 30 having been

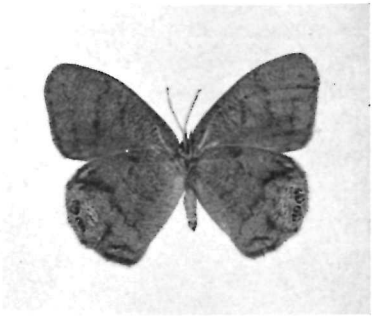

Fig. 8. *Neonympha dorothea*, female, under side.

taken before the first female was encountered. A worn male, presumably the last of the spring brood, was collected in Roaring Springs Canyon in early July, and a bright female, undoubtedly of the second brood, at Cape Royal in late August. All localities mentioned are Upper Sonoran Zone.

112. *Coenonympha furcae* B. & B. (S. Rim 10-vi-38 Schellbach; Yavapai 3-vi-40 Schellbach; B. A. Trail 9-vi-41 Nabokov; Hopi 17-v-47 Garth; also Hermit, Havasupai, and Bass)

Fig. 9. *Coenonympha furcae*, male.

THE GRAND CANYON RINGLET is the one park butterfly so restricted in habitat that it flies nowhere else in the world; yet if we accept its designation as *C. tullia furcae* by Davenport (Bull. Mus. Comp. Zool. Harvard, 87 [4]:270, 1941), we identify it with a widely ranging species which, originating in the Lake Baikal region of Central

Asia, has spread westward to Europe and, via Bering Strait, eastward to North America. It seems limited to the South Rim and canyon wall, no specimens having been taken on the North Rim. Yet it is to the north that one must look for its nearest relative, *C. ochracea* Edw., which ranges from Canada south through Colorado to Nevada and Utah. Within the territory in which it flies, *furcae* is perhaps the most abundant butterfly and may be netted four or five at a time over heads of *Gaillardia* or Goldeneye (*Viguiera*). In the brushy second growth of burned-over pinyon, netting it is a different matter, as it flies close to the ground and is easily lost to sight once it alights among the grasses which are its larval food plants. Early June is the favored season, but the writer has taken it on the rim in mid-May.

115a. *Eumenis ridingsii dionysus* Scud. (Havasupai 6-vi-42 Garth; Royal 10-vi-47 Schellbach; Swamp Point 10-vii-47 Adams; also Muav and Swamp Lake)

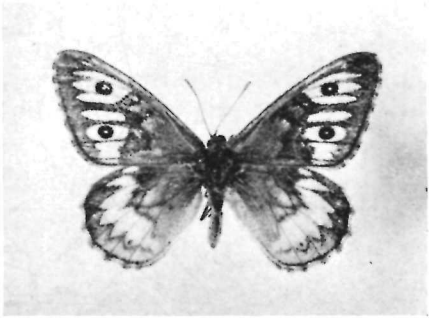

Fig. 10. *Eumenis ridingsii dionysus*, male.

No single butterfly discovery at the Grand Canyon has given the writer keener satisfaction than finding SCUDDER'S SATYR present over large areas of the Park. The following is an extract from field notes dated June 6, 1942: "The first three were encountered in open sage flat near Pasture Wash. They became more numerous as we approached Havasupai Point, where they flew like grasshoppers, alighting on bare ground or rock among gray lichens and tipping with the wind until almost flat and totally indistinguishable against this background. They flew in open places among pinyon and juniper over grasses." In mid-July some five years later worn specimens, mostly females, were taken on the hot slopes of Muav Saddle between Swamp Point and Powell Plateau. It is thought to be through this pass that they have been able to cross the Grand Canyon and establish them-

selves on the slopes of the San Francisco Peaks beyond.

119.1 *Minois masoni* Cross (Royal 5-vii-30 and 26-vii-40 Hewes; N. Rim 3-viii-38 Schellbach; B. A. Trail 11 to 23-vi-43 Schellbach; Yavapai 14 to 30-viii-44 Schellbach; also Hermit, Roaring Springs, Muav, Powell, and Sublime)

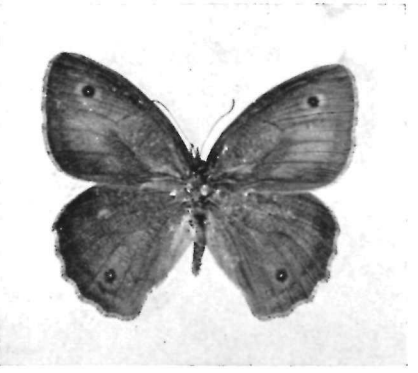

Fig. 11. *Minois masoni,* male.

MASON'S WOOD NYMPH flies at both rims. At the South Rim it is the only wood nymph, while at the North Rim it may be taken in company with *M. oetus phocus.* However, it is invariably noted that the former fly up from the hot canyon walls, while the latter fly out of the cool fir and aspen shaded glades to mingle on the canyon's brink. Although determined by J. F. G. Clark as *M. alope* Fabr., Grand Canyon specimens sent by L. I. Hewes to F. C. Cross were found to be identical with the Colorado species.

120. *Minois damei* B. & B. (Royal 18-viii-46 Garth and 7-vii-47 Adams; Sublime 22-viii-46 Garth)

DAME'S WOOD NYMPH flies in abundance among the pinyons at Desert View on the north slope of the Kaibab Plateau outside park boundaries, where a small series was taken on July 17, 1947. Since *damei* and the nearly related *M. meadi* Edw. are the only wood nymphs with bright red on the primaries above and below, the occasional reddish specimen taken with *M. masoni* at such places as Point Sublime and Cape Royal is assumed to be *damei* also, for the species would have access to the Grand Canyon around either side of the Kaibab Plateau.

124a. *Minois oetus phocus* Edw. (N. Rim 18-viii-34 Lutz; N. Rim 14-viii-38 Schellbach; Neal 18-viii-46 and 5-vii-47 Garth; also

Royal, Kanabownits, Swamp Ridge, Powell, and Transept)

The Northern Rocky Mountain race of THE LEAST SATYR is the one present at the North Rim, in the opinion of J. A. Comstock and the writer. True, individual specimens sent to J. F. G. Clark have been determined merely as *M. oetus* Bdv., but of a series of nearly two dozen individuals, slightly more than half fulfill the description of *phocus*. Dates from early July to late August are recorded, the badly worn specimens taken in the latter month indicating but a single brood. The Colorado Rubber Plant (*Actinea subintegra*) holds a peculiar attraction for these diminutive Satyrs, which alight on its yellow blossoms with the avidity displayed by *Coenonympha furcae* for Goldeneye (*Viguiera*). Males have ordinarily one less eyespot on the primaries than females, although the second is often faintly present.

NYMPHALIDAE (THE BRUSH-FOOTED BUTTERFLIES)

159. *Euptoieta claudia* Cram. (S. Rim 22-vi-30 collector unknown)

THE VARIEGATED FRITILLARY ranges over the entire Coconino Plateau, having been taken by E. L. Bell at Williams and by the writer between Jerome and Prescott, considerably to the southward. Beyond Arizona it continues eastward to New England and southward to Central America and northern South America. A wide variety of food plants in addition to Passion Vine (*Passiflora*) are accepted.

171d. *Argynnis atlantis schellbachi* Garth (N. Rim 29-vii-39 Schellbach; Two River 28-vii-45 Schellbach; Neal 16-viii-46 and 5-vii-47 Garth; also Robbers Roost, Swamp Lake, and Kanabownits)

SCHELLBACH'S FRITILLARY, described by the writer as *Speyeria atlantis schellbachi* (Bull. So. Calif. Acad. Sci., 48:1, 1949), flies in July and August on the Kaibab Plateau, preferring such secluded draws as are to be found at Neal, Kanabownits, and Robbers Roost Springs. Wild and elusive in the early season, it may be captured readily after the cream-colored *Cirsium* comes into bloom, for it cannot resist the temptation to gorge its fill of thistle nectar in the late afternoon hours.

Although the name *Speyeria* was proposed with good reason by Dos Passos and Grey (Am. Mus. Novitates, no. 1297, 1945) for the North American fritillaries formerly referred to *Argynnis*, and will no doubt be adopted by authors of technical papers, the advantages of retaining the more familiar name in a popular manual of this sort are obvious. The new subspecies, named for park naturalist Louis Schellbach, finds

its closest affinity with *A. chitone* of southern Utah, now considered to be a race of *atlantis* also.

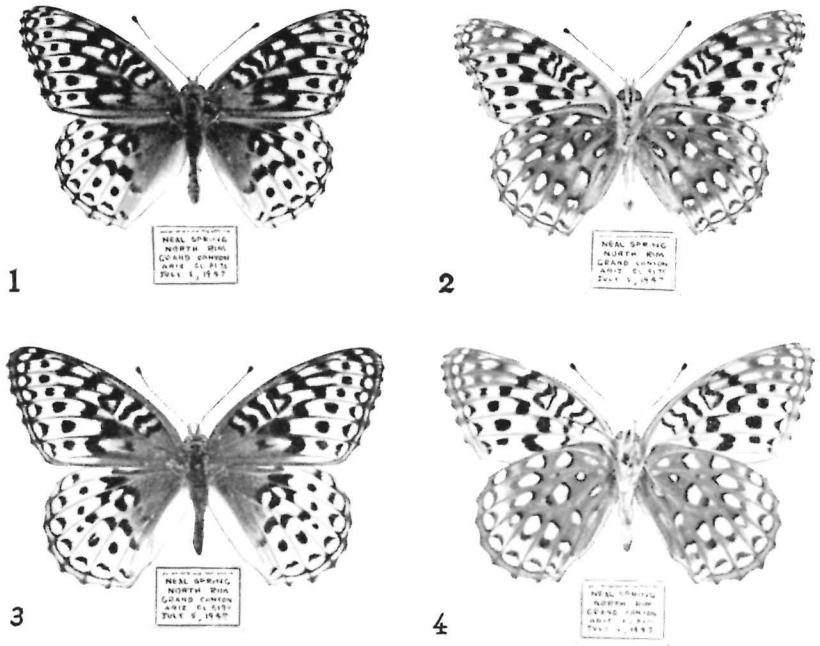

Fig. 12. *Argynnis atlantis schellbachi.* Upper two figures, male holotype; lower two figures female allotype; right hand figures, under side. Approximately three-fourths natural size.

181. *Argynnis snyderi* Skin. (Swamp Lake 12-vii-47 Garth)

A single female of SNYDER'S FRITILLARY was netted while flying swiftly over Colorado Rubber Plant in the almost dry bottom of Swamp Lake, North Rim. A wide submarginal band of yellow-buff occurs on the under side of the secondaries. When additional specimens of this Great Basin flier are captured, it may be possible to segregate from the parent stock a Grand Canyon race.

227. *Euphydryas hermosa* Wgt. (N. Rim 2-vii-38 Schellbach; Yavapai 5-vi-42 Garth; Bass 6-vi-42 Garth; B. A. Point 7-vi-44 Bryant)

It is with some hesitation that the name *hermosa* is applied to the *Euphydryas* which flies at Grand Canyon, even with confirmation of the Schellbach specimen as *hermosa* by J. F. G. Clark. A more conservative course would be to follow W. D. Field, who determined the

Bryant specimen merely as *Euphydryas* sp. The writer has already expressed the belief that Wright's species is to be looked for in Southern Arizona, and has referred to it an *Euphydryas* from the Ajo Mountains, on the Mexican border (*Ent. News*, 55:120-121, 1944). Grand

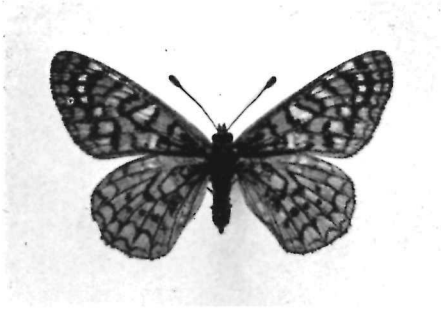

Fig. 13. *Euphydryas hermosa*, female.
—U. S. National Museum Photo.

Canyon specimens, lighter and smaller in size, appear more closely related to the *Euphydryas* from the Providence Mountains of southeastern California. These are a desert race of *E. chalcedona* Hew. and are *Scrophularia* feeders. It is apparent that the name *hermosa* is too loosely applied, and that a clarification of the relationships of Arizona *Euphydryads* is in order.

237. *Melitaea neumoegeni* Skin. (B. A. Trail ?-v-29 Duncan; River Trail 30-viii-45 Arnberger; Phantom 23 to 25-iii-48 Garth)

NEUMOEGEN'S CHECKER SPOT is one of the earliest fliers of the canyon bottom, having been taken at the delta of Bright Angel Creek by the writer in March. It flits about the sunlit trail in the vicinity of the Colorado River suspension bridge, alighting on the warm sand or on the palm of one's outstretched hand. The species was described originally from Utah. A pale form flies in the adjacent arid areas of eastern California, such as Coachella Valley, Mojave Desert, and Mono Basin. Comstock, who identified the Duncan specimens, calls it "a true child of the desert." The larval food plant is *Aster*.

240. *Melitaea acastus* Edw. (N. Rim 14-vi-38 Schellbach; Yavapai 3-vi-42 Garth; Bass 6-vi-42 Garth)

THE ACASTUS CHECKER SPOT flies on the South Rim in early June, putting in its appearance at the North Rim some two weeks later and continuing through July. A Great Basin species, it is found as far

west as the crest of the Sierra Nevada. The larval food plant is unknown.

251. *Melitaea fulvia* Edw. (Indian Gardens ?-v-29 Duncan; Hermit 4-vi-42 Garth; Hopi 17-v-47 Garth)

THE FULVIA CHECKER SPOT is an Upper Sonoran flier having its principal distribution to the south and east of Grand Canyon National Park. The Duncan specimen was determined by J. A. Comstock. A freshly emerged specimen was netted at the canyon's brink in mid-May, having just flown up from below. The food plant is Indian Paint Brush (*Castilleja*), of which many species occur in the Park.

253. *Melitaea pola* Bdv. (Checking Station 18-vii-49 Schellbach)

THE POLA CHECKER SPOT is a creature of the high mountain meadows, as attested to by its capture at Checking Sation Meadows at the north entrance to the park, at an altitude of 9,000 feet, by the park nauralist, Louis Schellbach. Its Sierra Nevadan counterpart flies at a comparable elevation at Monache Meadows, reached from the desert town of Olancha, in Inyo County, California. The female specimen taken by Mr. Schellbach is larger, darker, and with the wings less angular and more rounded than specimens taken on the South Rim, or at elevations of less than 8,000 feet at the North Rim, to which the racial designation *arachne* is applied. It is thought that the affinities of *pola* lie to the north, rather than to the south of the Kaibab Plateau.

a. *arachne* Edw. (N. Rim v-vii-38 Schellbach; Hearst 2-vi-42 Garth; Bass 6-vi-42 Garth; Neal 26-vi-42 Bryant; also Yavapai, Hermit, Aspen Glen, Tipover, Cliff Springs, Roaring Springs, Swamp Ridge, and Powell)

Fig. 14. *Melitaea pola arachne*, female.
—U. S. National Museum Photo.

THE ARACHNE CHECKER SPOT, as determined by J. F. G. Clark and W. D. Field, is abundant at both rims, at the South in early

June, at the North in early July. It is first to be sought along Rowes Well Road in the canyon below Bass, where the lower elevation brings on the season a week or two in advance of Grand Canyon Village and environs. Only the less elevated portions of the North Rim, such as Swamp Ridge, Lower Neal Spring, and Cape Royal, appear to be favored by this butterfly. An early season flier, *arachne* is said by Holland to be common in Colorado. The parent species feeds on *Penstemon.*

265b. *Phyciodes tharos pascoensis* Wgt. (Indian Gardens ?-v-28 Duncan; Aspen Glen 10-vi-42 Garth; B. A. Trail 22-vi-43 Schellbach)

A single female specimen of THE PASCO CRESCENT was taken by the writer in the small aspen grove 16 miles east of Grand Canyon Village which represents an island of Canadian Zone vegetation in the South Rim's extensive Transition area. At the time it was thought to be *P. batesii*, a North Rim species (See below). However, it proved to be identical with specimens collected far down in the canyon by Duncan and determined by J. A. Comstock as *pascoensis*, rather than a northern flier which had succeeded in negotiating the canyon.

266. *Phyciodes batesii* Reak. (N. Rim 18-vii-34 Lutz)

The occurrence of BATES' CRESCENT in Grand Canyon National Park was suggested by the presence in the Naturalist Workshop collection of a specimen from Long Island, N. Y. On the chance that it might have been sent to the park naturalist as a substitute for a specimen collected in the Park, the writer made inquiry at the American Museum of Natural History and Dr. Charles Michener located the specimen on which the above record is based. It is one of the few specimens included in this report which has not been seen and the identification verified by the writer. The larval food plant is *Aster.*

267a. *Phyciodes campestris camillus* Edw. (Hearst 2-vi-42 and 17-v-47 Garth; Kanabownits 8-vii-47 Garth; also Bass, Transept, and Neal)

THE CAMILLUS CRESCENT was taken by the writer in mid-May at Hearst Tanks, along with *Coenonympha furcae* and *Erynnis propertius.* This establishes it as one of the earliest fliers on the South Rim, only Ingham's Orange Tip and the California White appearing earlier. *Camillus* is the small meadow crescent with black predominant over yellow, at least in the male. The range of the subspecies is from British Columbia to Texas. The food plant is *Aster foliaceus.*

270. *Phyciodes mylitta* Edw. (N. Rim 20-vi-42 Bryant)

THE MYLITTA CRESCENT, with the possible exception of *Papilio bairdii* Edw., is represented at Grand Canyon by more forms than any other butterfly, showing again how diversity of terrain brings together here races normally distributed over the western half of North America. The specimen above was determined by J. A. Comstock. The larval food plant is thistle (*Carduus* or *Cirsium*).

a. *pallida* Edw. (N. Rim 23-vi-40 Schellbach)

THE PALLID CRESCENT, as determined by Wm. D. Field, was taken at the North Rim in June by the park naturalist, Louis Schellbach.

b. *barnesi* Skin. (N. Rim 11-vi-38 Schellbach; Neal 5-vii-47 Garth; also Tipover, Kanabownits, Powell, Swamp Lake, and Swamp Ridge)

Fig. 15. *Phyciodes mylitta barnesi*, male.

BARNES' CRESCENT is the usual North Rim form, the first listed specimen above having been so determined by J. F. G. Clark. It is large and light in color and cannot be confused with the following subspecies. With Colorado given as the type locality, the distribution of *barnesi* is to the northward.

c. *thebais* G. & S. Hermit 4-vi-42 Garth; Bass 9-vi-42 Garth; Village 18-viii-46 Schellbach)

THE THEBAIS CRESCENT is the South Rim representative of the species. Specimens taken at Hermit Basin and near Bass in early June were already worn; specimens netted on the rim, because of the higher elevation and later date of emergence, were fresher. A small, dark race of *mylitta*, it remains, however, larger and lighter than *camillus*, with which it flies. Its distribution is southward and eastward.

287. *Polygonia satyrus* Edw. (Hermit 4-vi-42 Garth; Neal 5-vii-47 Garth; Roaring Springs 9-vii-47 Garth)

THE SATYR flies along watercourses, or wherever sufficient moisture occurs to support its food plant, nettle. In addition to the records above, it has been seen about Kanabownits Spring in early July. At Roaring Springs it was observed to alight on the trunks of willow and maple. The species ranges from Ontario westward.

291. *Polygonia zephyrus* Edw. (N. Rim 14-viii-38 Schellbach; Neal 5-vii-47 Garth)

Fig. 16. *Polygonia zephyrus*, male.
—U. S. National Museum Photo.

THE ZEPHYR is a Rocky Mountain member of the angle-wing clan. A Canadian Zone flier, it has been taken in the Park only at the North Rim. Azalea, gooseberry, and currant are among its chosen food plants.

296. *Nymphalis californica* Bdv. (Village 16-vi-45 Bryant; Royal 3-vii-46 Schultz; Neal 10-vii-46 Arnberger)

THE CALIFORNIA TORTOISE-SHELL was first collected in the Park by superintendent H. C. Bryant, who early in his scientific career was called upon to investigate an outbreak of this butterfly in Northern California for the U. S. Department of Agriculture. The species ranges throughout California and Oregon and east to Colorado. The food plant of the web-spinning larvae is *Ceanothus*.

298. *Nymphalis antiopa* L. (N. Rim 10-viii-38 Schellbach; Aspen 10-vi-42 Garth; sight records: Hermit, Neal, and Transept)

THE MOURNING CLOAK is represented in the Naturalist Workshop by a series of 15 specimens, all from the North Rim in August.

South Rim records are for June, North Rim sight records for July. Larval food plants are willow and poplar, of which the Quaking Aspen (*Populus tremuloides*) is the Kaibab Forest representative.

299. *Vanessa atalanta* L. (N. Rim 11-vi-38 Schellbach)

THE ALDERMAN, preferred as a common name to THE RED ADMIRAL because of possible confusion with members of the genus *Basilarchia*, is a widely distributed butterfly not common at the Grand Canyon, where it has been taken but once, at the North Rim. The food plant is nettle (*Urtica*).

300. *Vanessa virginiensis* Dru. (Neal 4-vii-47 Garth; Swamp Lake 14-vii-47 Garth)

THE VIRGINIA LADY, also called HUNTER'S BUTTERFLY, is one species calculated to occur within Grand Canyon National Park of which no specimen was contained in the local collection and for which a determined search was made. It finally yielded to the net at two widely separated North Rim localities, Neal Spring and Swamp Lake, in July. Food plants are *Gnaphalium* and *Antennaria*, both represented in the Park.

301. *Vanessa cardui* L. (N. Rim 11-vii-35 McKean; Hermit 4-vi-42 Garth)

THE PAINTED LADY occurs wherever its food plant, thistle (*Carduus*), is found. An early park record from a North Rim C. C. C. Camp is given above.

302. *Vanessa carye* Hbn. (N. Rim 13-viii-39 Schellbach; Transept 12-viii-46 Garth)

THE WEST COAST LADY is more restricted in distribution than the former species. It feeds preferably on mallow, but will accept lupine, or even nettle. The determination on the first specimen recorded above is by Carl Heinrich.

323a. *Basilarchia weidemeyerii sinefascia* Edw., form *angustifascia* B. & McD. (N. Rim 29-vi-37 Ricco; N. Rim 8-vi-38 Schellbach; Kanabownits 29-vii-45 Schellbach; Tipover 4-vii-47 Garth; also Neal and Robbers Roost)

The precise determination of the moderately narrow-banded form of WEIDEMEYER'S ADMIRAL which occurs on the Kaibab Plateau is open to debate. In deference to the desire of park officials to adopt U. S. National Museum identifications for Naturalist Workshop col-

lections, the determination made by J. F. G. Clark on North Rim specimens collected by the park naturalist, Louis Schellbach, in June and July of 1938 is given above. However, J. A. Comstock considers a specimen submitted from the same series to be midway between typical *weidemeyerii* and *angustifascia*, while W. D. Field labeled the Kanabownits specimen above *sinefascia*. In point of width of white bands it is intermediate between the two races, as it is mid-way between their type localities, the one in Colorado, the other in the White Mountains of eastern Arizona. Males are normally wider banded than females. The Admirals are attracted to coyote dung or steer manure and may be netted by half-dozens while eagerly imbibing the putrescent juices. Food plants are poplar, aspen, and willow.

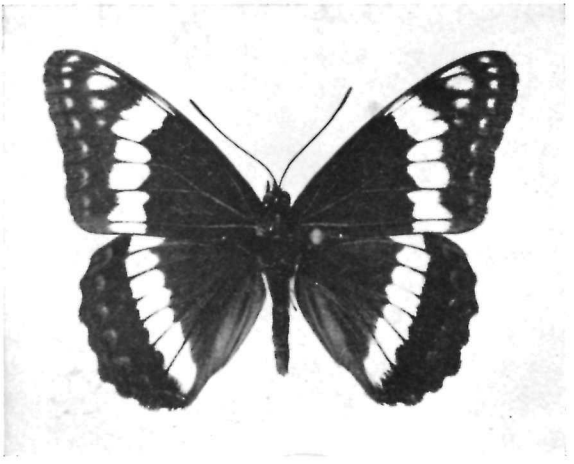

Fig. 17. *Basilarchia weidemeyerii angustifascia*, male.

325b. *Basilarchia archippus obsoleta* Edw. (Phantom 27-vii-34 Rockefeller)

THE ARIZONA VICEROY, also called HULST'S ADMIRAL, has been taken but once in Grand Canyon National Park, at the very bottom of the canyon. Common around Yuma and Blythe, the insect follows the Colorado River northward and eastward to Utah, feeding on the cottonwoods and willows which fringe its banks. It is a mimic of the protected species, *Danaus berenice* Cram. For a meticulous account of the life history of this several-brooded insect, see Comstock and Dammers (Bull. So. Calif. Acad. Sci., 32:27, 1933).

326b. *Heterochroa bredowii eulalia* Dbl. (S. Rim 28-v-35 McKee; S.

Rim 6-ix-38 Schellbach; Aspen Glen 10-v-42 Garth; also Hermit and Roaring Springs; sight record: Neal 5-vii-47)

THE ARIZONA SISTER flies in the oak-covered ravines of the canyon wall. Arizona and New Mexico specimens are uniformly larger and the ground color much blacker than their California "sisters" (or brothers, as the case may be!), and for them the name *eulalia* has been raised from synonymy by Carpenter and Hobby (Trans. R. Ent. Soc. London, 94[2]:311 ff., 1944), who mention a single specimen from Grand Canyon as "the only evidence that the species occurs there." It is on the wing at the South Rim from late May and at the North Rim (Neal Spring) from early July. The food plant is *Quercus*.

328. *Asterocampa leilia* Edw. (Indian Gardens 23-vii-34 Bell)

THE EMPRESS LEILIA flies in the lower elevations of the park, judging from the single specimen recorded above. It is larger and deeper reddish brown than its near relative, the Empress Antonia. Members of the genus are known to feed on Hackberry, represented in the Grand Canyon by *Celtis reticulata*, found at Dripping Springs, in Havasu Canyon, and along Bright Angel Trail.

LIBYTHEIDAE (THE SNOUT BUTTERFLIES)

336. *Libythea bachmanii* Kirt. (S. Rim 13 to 16-vi-42 Wasem; Village 1-x-47 Schellbach)

A single specimen of THE SNOUT BUTTERFLY, so called because of the unusual prolongation of the labial palps, was shown to the writer by Don Wasem while at the Grand Canyon in June, 1942. Taken at the South Rim earlier that month, it was the last of Wasem's records to be duplicated by later collecting. The Naturalist Workshop collection now contains a beautiful specimen obtained by the park naturalist on an October date. As with the preceding species, the larval food plant is hackberry (*Celtis*).

RIODINIDAE (THE METAL MARKS)

337. *Apodemia mormo* F. & F. (B. A. Trail 3-ix-46 Carswell; sight record: Sublime 22-viii-46 Garth)

THE MORMON METAL-MARK was netted along Bright Angel Trail by D. F. Carswell, in early September, 1946, less than a month after it had been seen, but not captured, by the writer at Point Sublime. It is apparently the Great Basin, rather than the desert form,

which flies at Grand Canyon, although race *deserti* B. & McD. may also occur in the canyon bottom. The food plants are buckwheat (*Eriogonum*) and saltbush (*Atriplex*).

LYCAENIDAE (THE HAIR-STREAKS, COPPERS AND BLUES)

353. *Hypaurotis chrysalus* Edw. (N. Rim 16-vi-39 Schellbach; Neal 19-vii-46 Arnberger; Roaring Springs 9-vii-47 Garth; also Muav and Powell)

Fig. 18. *Hypaurotis chrysalus*, male.

THE COLORADO HAIR-STREAK is one of the choice catches of the Park. It flies among the oak and locust-covered canyon walls and may be encountered in July by walking a short distance down the Kaibab Trail from the North Rim. The easiest time for netting it is just before dusk, when it alights on the outermost twigs of Gambel's Oak to enjoy the last rays of sunshine. At Muav Saddle it was so abundant that collecting was curtailed after the second day. The species was observed by Phillip Adams to continue to fly during a heavy summer shower. As implied by its common name, the species ranges into Colorado. The food plant is oak.

356. *Atlides halesus* Cram. (Yavapai 9 to 12-viii-43 and 17-viii-44 Schellbach)

Specimens of THE GREAT PURPLE HAIR-STREAK collected at Yavapai Point by L. Schellbach and L. Arnberger in mid-August have been identified by W.D. Field as form *estesi* Clench, a name which does not appear on the McDunnough 1938 Check List. The larval food plant of this brilliantly irridescent butterfly is mistletoe, rather than the live oak which supports the parasitic plant.

373. *Strymon melinus* Hbn. (S. Rim. 6 to 17-vii-30 collector unknown; Yavapai 22-viii-44 Schellbach; Muav 13-vii-47 Garth; also Powell and Royal)

THE COMMON HAIR-STREAK flies on the South Rim in June and on the North Rim in July, where it has been taken only in exposed localities. The food plant is mallow (*Malva*).

a. *pudica* Hy. Edw. (Supai 4-viii-36 Bell)

The pale form flies in Havasu Canyon, and probably also on the Tonto Plateau, judging from the August record of E. L. Bell above.

392. *Strymon saepium* Bdv. (S. Rim 15-vi-30 collector unknown; Roaring Springs 9-vii-47 Garth)

THE HEDGE ROW HAIR-STREAK was encountered abundantly but very locally in Roaring Springs Canyon above the falls. Although it was early July, they were past their prime, most of the specimens being worn females. The species ranges north into Utah and Colorado. The food plant is *Ceanothus*.

394. *Callipsyche behrii* Edw. (S. Rim 16-vi-30 collector unknown; Hermit 4-vi-42 Garth; Muav 13-vii-47 Garth)

Although BEHR'S HAIR STREAK is always found near pinyon pine, its food plant, according to J. A. Comstock, is *Purshia*, a member of the Rosaceae. Since *Purshia* is not known to occur in Grand Canyon National Park, one of two closely related genera, *Chamaebatiaria* and *Coleogyne*, is strongly suspected of nurturing *behrii* in this region. The Hermit Basin and Muav Saddle localities given above are both within the pinyon pine zone (Upper Sonoran).

396. *Mitoura spinetorum* Hew. ("Rim" ?-v-30 collector unknown; Hermit 4-vi-42 Garth; Yavapai 12 to 18-vii-44 Schellbach; Swamp Ridge 16-vii-47 Garth)

THE THICKET HAIR-STREAK was first encountered by the writer in Hermit Basin in June of 1942, although an earlier specimen with inadequate data is in the Naturalist Workshop collection. Grand Canyon specimens show but faintly the white W on the under side of the secondaries which when clearly present was said to characterize Wright's *cuyamaca*. The food plant is Dwarf Mistletoe (*Arceuthobium campylopodium*), common on pinyon pine at both North and South Rims.

399. *Mitoura siva* Edw. (S. Rim 12-v-30 collector unknown; Bass 6-vi-42 Garth; also Hermit and Neal)

Fig. 19. *Mitoura siva*, male, under size.

THE JUNIPER HAIR-STREAK ranges widely over the Coconino Plateau, specimens having been taken near Sedona below Oak Creek Canyon. In spite of the similar common name, this is not race *juniperaria* Comst. of Southern California, of which early stages are figured by Comstock, although the life history is undoubtedly similar. Preference for blown tassels of the Cliff Rose, *Cowania stansburiana*, was noted at Hermit Basin in June, when two dozen specimens were netted.

412. *Incisalia eryphon* Bdv. (N. Rim 3-vi-39 Schellbach)

THE WESTERN BANDED ELFIN is a very early flier in the Canadian Zone which has been taken only once to our knowledge at Grand Canyon, and that due to the diligence of park naturalist Louis Schellbach. The food plant is believed to be a conifer, perhaps fir or spruce.

417a. *Callophrys apama homoperplexa* B. & Benj. (Far View 10 to 12-vi-42 Wasem; Cliff Springs 23-v-47 Schellbach; Tipover 4-vii-47 Garth; also Neal, Swamp Ridge, and Swamp Lake)

It was a specimen of THE APAMA HAIR-STREAK shown to him by the late Don Wasem which first alerted the writer to the possibilities of early season collecting at the North Rim. Wasem's record from Far View Point remained unique for five years until duplicated by the park naturalist at Cliff Springs in May and by the writer at several North Rim localities in July of 1947. Judging from the food habits of other members of the genus, *apama* is believed to be a buckwheat feeder. The race *homoperplexa* shows a discontinuous red line on the under side of the secondaries. It ranges northward into Colorado and Wyoming.

421. *Tharsalea virginiensis* Edw. (N. Rim 18-vii-35 Bell; B. A. Trail 22-vi-43 Schellbach; also Neal and Roaring Springs)

Fig. 20. *Tharsalea virginiensis*, under side.

THE NEVADA COPPER was found commonly at Lower Neal Spring and at a point 1.6 miles below the North Rim on the Kaibab Trail where gooseberries (*Ribes*) grew abundantly. W. D. Field has suggested that the Grand Canyon specimens may represent a new race. Although larger and darker than typical specimens from Virginia City, Nevada, they are not as large and dark as specimens in the Naturalist Workshop collection from Jemez, New Mexico. It is the latter butterfly, in the opinion of the writer, which deserves a racial name.

423b. *Lycaena heteronea gravenotata* Klots (N. Rim 20-viii-42 Bryant; Harvey 13-viii-46 Garth; Neal 18-vii-47 Garth)

It is perhaps stretching a point to call the race of THE VARIED BLUE which flies on the Kaibab Plateau *gravenotata*, but this is done to stress its relationship with the Colorado form. The spots of the under side of the secondaries, although graying, have not the washed appearance which characterizes typical *heteronea*. Although males of the species are bright blue, the females have the brownish appearance of a Copper, and it is in the latter group that the species belongs. Race *clara* Hy. Edw. feeds on *Eriogonum fasiculatum*, of which var. *polifolium* occurs at the North Rim.

439. *Leptotes marina* Reak. (Supai 2-viii-34 Bell; Tipover 4-vii-47 Garth; also Neal and Swamp Lake)

THE MARINE BLUE is as characteristic a Pacific Slope butterfly as the West Coast Lady. It is widely distributed, both horizontally and vertically. Loco weed (*Astragalus*) is a recorded food plant, and the

writer has reared it successfully on cultivated *Plumbago.*

440. *Brephidium exilis* Bdv. (Supai 4-viii-34 Bell)

THE PYGMY BLUE. It is a paradox indeed that the world's smallest butterfly, expanse 0.65 inch, should fly in the world's largest canyon, the Grand Canyon of the Colorado. The food plant, saltbush (*Atriplex canescens*), grows at Phantom Ranch, along Bright Angel Trail, in Pasture Wash, along Shinumo Creek, and the Havasu Canyon, where the single specimen above was taken.

444. *Hemiargus gyas* Edw. (Phantom 12-viii-34 Bell; Tipover 4-vii-47 Garth; also Neal and Robbers Roost)

Never abundant anywhere, EDWARD'S BLUE occurs at a surprising number of localities within the Park, from the bottom of Grand Canyon to well above the North Rim. The omnipresence of its food plants, *Astragalus* and, at lower elevations, *Prosopis* (Mesquite), is perhaps the reason for its wide distribution.

446. *Hemiargus isola* Reak. (S. Rim 23-vi-30 collector unknown; N. Rim 20-viii-42 Bryant; Hermit 4-vi-42 Garth; also Yavapai, Tipover, Neal, and Kanabownits)

REAKIRT'S BLUE may be told at once from the preceding species by a row of black spots on the under side of the primaries. The Bryant specimen listed above was determined by J. A. Comstock. The butterfly has a southern distribution, ranging into Mexico. The food plant is unknown.

447a. *Everes comyntas herrii* Grin. (N. Rim 25-viii-38 Schellbach; Hearst 2-vi-42 Garth; Aspen Glen 10-vi-42 Garth; also Hermit and Neal)

Although determined by J. F. G. Clark as *E. amyntula herrii*, it is the EASTERN TAILED BLUE, rather than the Western, which is represented at Grand Canyon by the Arizona race. *Herrii* differs from the parent species by having a black border. Food plants are members of the Leguminosae.

450. *Plebeius melissa* Edw. (S. Rim 6-vi-30 collector unknown; Bass 6-vi-42 Garth; Hull 18-vi-46 Arnberger; Royal 21-viii-46 Garth; Cliff Springs 10-vi-47 Schellbach)

THE ORANGE-MARGINED BLUE is perhaps the commonest of the "azure blues" to be found at the South Rim. The only other Park blue in which the orange extends onto the primaries is Spalding's Blue,

found exclusively at the North Rim. The food plants are *Astragalus* and *Lotus*.

452a. *Plebeius aquilo rustica* Edw. (Neal 10 to 12-vi-42 Wasem; Tipover 4-vii-47 Garth; also Checking Station, Roaring Springs, and Swamp Lake)

THE RUSTIC BLUE is an early North Rim flier, being on the wing from early June to mid-July. The highest mountain meadows, such as the 6-mile long Checking Station Meadow, elevation 9,000 feet, are its habitat, although it has been taken along the Kaibab Trail just below the North Rim. It is the Rocky Mountain race, not the Sierra Nevadan, which is represented on the Kaibab Plateau. The males are grayish, the females brown. The food plant is not known.

453. *Plebeius saepiolus* Bdv. (N. Rim 7-vi-44 Bryant; Greenland Lake 10-vi-47 Schellbach; Tipover 4-vii-47 Garth; also Checking Station, Neal, Roaring Springs, and Robbers Roost)

The Grand Canyon race of THE GREENISH BLUE is perhaps closest to *gertschii* Dos Passos, which is the Utah form. It flies in identical situations with the preceding species and cannot always be distinguished from it on the wing. The large size of the dark spots on the under side of the wing and the deep blue of the males is characteristic. Alpine clovers are said to be the food plant of the species.

455d. *Plebeius icarioides lycaea* Edw. (N. Rim 7-vii-38 Schellbach; Yavapai 9-vi-42 Garth; also Hearst, Aspen, Tipover, and Powell)

THE LYCAEA BLUE, as determined by J. F. G. Clark, is tolerant of lower elevations and more arid situations than are the two preceding species. It occurs wherever lupines are found, which means over practically all of Walhalla and Powell Plateaus, plus large South Rim areas where lupine forms a cover growth beneath yellow pine. The range of the subspecies is Rocky Mountains from Montana to northern Mexico. The Naturalist Workshop collection contains a specimen collected by F. E. Lutz on the San Francisco Peaks.

459. *Plebeius acmon* West. & Hew. (Hearst 2-vi-42 Garth; Powell 18-vii-47 Garth; also Yavapai, Bass, and Neal)

THE ACMON BLUE enjoys a wide range because of its acceptance of several food plants, among them *Hosackia*, *Eriogonum*, and *Lotus*. It is several brooded, the earlier brood differing in appearance from the later. Males are blue, females brown, sometimes with bluish overcast, and both sexes have orange-margined secondaries.

466b. *Philotes glaucon centralis* B. & McD. (Powell 18-vii-47 Garth; Sublime 22-viii-46 Garth)

The central race of THE GLAUCOUS BLUE occurs on the outermost points of the North Rim, such as Dutton Point and Point Sublime. The identification, made by Rudolph Mattoni, a specialist in the group, strengthens the relationship of the North Rim fauna to that of the Great Basin. Mr. Mattoni is also the authority for the statement that there is no morphological basis for the separation of *glaucon* Edw. from *battoides* Behr, the species which precedes it on the McDunnough check list. The food plant is buckwheat (*Eriogonum*).

469. *Philotes spaldingi* B. & McD. (Tipover 4-vii-47 Garth; Swamp Lake 12-vii-47 Garth; also Robbers Roost and Royal)

Fig. 21. *Philotes spaldingi*, male.

SPALDING'S BLUE. If any proof of the relationship of the fauna of the Kaibab Plateau to that of the northern Rockies were needed, the finding here of Spalding's Blue should clinch the matter. A Utah-Colorado butterfly, it flies well within the zone of fir forest. Most abundant in a well-watered area at Tipover Springs, *spaldingi* was encountered sparingly at Cape Royal. The orange coloring extends onto the primaries of both sexes. The food plant is unknown.

473f. *Glaucopsyche lygdamus arizonensis* McD. (Hearst 2-vi-42 Garth; Aspen Glen 10-vi-42 Garth; Village 9-v-43 Bill; Village 22-v-45 Schellbach)

The Arizona race of THE SILVERY BLUE flies early in the season at the South Rim. It may be distinguished at once by its pale blueness and by the row of large ocelli on the under surface. The Colorado race, *oro* Scud., is to be anticipated at the North Rim. The food plants are *Astragalus* and *Lotus*.

475d. *Lycaenopsis pseudargiolus cinerea* Edw., form *arizonensis* Edw.

(Hermit 4-vi-42 Garth; N. Rim 20-viii-42 Bryant; Swamp Lake 14-vii-47 Garth; also Aspen Glen, Neal, Royal, Roaring Springs, Swamp Ridge, Transept, and Powell)

THE ARIZONA BLUE first takes wing early in the season, along with orange-tips and crescents. However, individuals of later broods are still to be found in late August. The Bryant specimen above was determined by J. A. Comstock. The larval food plant is *Ceanothus*.

HESPERIIDAE (THE SKIPPERS)

484. *Epargyreus tityrus* Fabr. (N. Rim 2-vii-38 Schellbach; Hermit 4-vi-42 Garth; also Neal, Greenland Spring, and Kanabownits)

THE SILVER SPOTTED SKIPPER is the largest of all the park Hesperiidae, and certainly the most conspicuous. It alights with wings folded in such a way as to expose the large silver spot on the under side of the secondaries. At the North Rim *tityrus* is a common sight hovering over Locust (*Robinia neomexicana*), its food plant.

505. *Thorybes pylades* Scud. (Aspen Glen 10-vi-42 Garth; Tipover 4-vii-47 Garth; also Hearst, Neal, Kanabownits, and Powell)

THE NORTHERN SKIPPER has been found at the South Rim only in the vicinity of Aspen Glen, an island of Canadian Zone some 16 miles east of Grand Canyon Village. At the North Rim it occurs at a variety of locations, the Kaibab Plateau being predominately Canadian Zone. Food plants include Indigo Bush (*Amorpha*) and the clovers.

518. *Pyrgus scriptura* Bdv. (Phantom 26-viii-34 Bell)

THE SMALL CHECKERED SKIPPER is locally a great rarity, being represented in the Naturalist Workshop collection by a single specimen from Oslar Gulch, Colorado. With the help of Charles D. Michener, a specimen from the bottom of Grand Canyon, recorded above, was located in the collections of the American Museum of Natural History. The species ranges throughout the Rocky Mountain region from Montana on the north to Arizona and New Mexico on the south. Nothing is known concerning its food plant or early stages.

521. *Pyrgus communis* Grt. (N. Rim 23-vi-40 Schellbach)

THE CHECKERED SKIPPER, as determined by W. D. Field, occurs at the North Rim.

a. *albescens* Ploetz (S. Rim 30-vi-30 collector unknown; Phantom 27-vii-34 Bell; S. Rim 30-viii-41 Schellbach; Yavapai 18-viii-44 Schellbach; also Bass, Swamp Ridge, and Powell)

THE WESTERN CHECKERED SKIPPER is the same insect referred to by Comstock in 1929 as *Urbanus tessellata occidentalis*, each of the names having been found inapplicable for reasons best known to specialists. The Yavapai specimen was determined by W. D. Field. The greater predominance of white over black distinguishes it from the parent species. Food plants are Mallow (*Malva*) and wild Hollyhock (*Sidalcea*), both of which occur in Grand Canyon National Park.

523. *Heliopetes ericetorum* Bdv. (Indian Gardens ?-v-31 Davis; same loc. 29-v-35 collector unknown; Hermit 4-vi-42 Garth; Bass 6-vi-42 Garth)

THE LARGE WHITE SKIPPER is undoubtedly more abundant in the park than the few records above would indicate. This is surmised from the distribution of its food plants, members of the Malvaceae, or Mallow family, and of Amaranth, three species of which have been found in Havasu Canyon.

528. *Pholisora alpheus* Edw. (Bass 9-vi-42 Garth)

THE ALPHEUS SOOTY-WING ranges eastward from the Coachella and Imperial Valleys of Southern California through Arziona and Nevada to New Mexico. It is a small dark skipper with a row of white spots on the under side of the secondaries. The single specimen collected two miles west of Bass along Rowes Well Road, outside the Park, is atypical. The food plant is *Atriplex*.

541. *Erynnis icelus* Scud. & Burg. (N. Rim 11-vi-38 and 3-vi-39 Schellbach)

THE DREAMY DUSKY-WING ranges across the United States and Canada. It is a small species, generously sprinkled with yellowish white, and with banded primaries. The determinations are by J. F. G. Clark and Carl Heinrich of the U. S. National Museum. Food plants are *Populus*, *Salix*, and *Quercus*.

543. *Erynnis burgessi* Skin. (Hermit 4-vi-42 Garth)

BURGESS' DUSKY-WING flies exclusively in Arizona. The narrow primaries are black, the secondaries brown. The determination is by Lloyd Martin of the Los Angeles Museum. Food plants of the species are unknown.

548. *Erynnis afranius* Lint. (N. Rim 1 to 3-vi-39 Schellbach)

THE AFRANIUS DUSKY-WING ranges from Colorado to California and southward to Arizona. It is a gray powdered species. A long series in the Naturalist Workshop collection was determined by Carl Heinrich. Food plants are *Lotus*, *Ceanothus*, *Salix*, and *Populus*.

551. *Erynnis juvenalis* Fabr. (N. Rim 12-v to 14-vi-38 Schellbach; Greenland Lake 2-vi-38 Schellbach)

JUVENAL'S DUSKY-WING ranges throughout the entire United States and part of Canada as contrasted with the following, a western species. The white spots on the fore wings are conspicuous. J. F. G. Clark of the U. S. National Museum determined the first specimen listed above. Food plants are said to be oak and legumes.

552. *Erynnis propertius* Scud. & Burg. (Indian Gardens ?-v-28 Duncan; Aspen Glen 10-vi-42 Garth; Hearst 17-v-47 Garth; also Royal and Sublime)

Fig. 22. *Erynnis propertius*, female.

THE PROPERTIUS DUSKY-WING is a large gray species with less conspicuous white spots on the primaries than the above. The Duncan specimen was determined by J. A. Comstock. It ranges throughout the west from Canada to Texas. The food plant is *Quercus*.

560. *Erynnis funeralis* Scud. & Burg. (Muav 13-vii-47 Garth; Powell 15-vii-47 Garth)

THE FUNEREAL DUSKY-WING is a white-margined species. It was found commonly alighting in the hot trails of Muav Saddle, between Swamp Point and Powell Plateau. Food plants are alfalfa and burr-clover in cultivation, *Nemophila* and *Hosackia* in the wild.

564. *Butleria pirus* Edw. (Far View 28-vii-45 Schellbach; Neal 5 to 11-vii-47 Garth)

THE PIRUS SKIPPERLING is a minute species (less than one inch expanse) occurring abundantly at North Rim meadows. Five specimens from the first locality were determined by W. D. Field. Almost devoid of markings, it may be distinguished by tiny white dots on the brownish primaries. The species ranges northward through Utah to Colorado. The food plant is not known.

569. *Oarisma garita* Reak. (Tipover 4-vii-42 Garth; Neal 5-vii-42 Garth; also Swamp Ridge)

THE GARITA SKIPPERLING resembles the former species and occurs in similar situations. However, the tiny white spots on the primaries are lacking and the under side is orange brown. *Garita* is an Arizona flier, occurring also on the slopes of the San Francisco Peaks, and ranges northward into Colorado. Grasses are its chosen food plants.

573. *Copaeodes aurantiaca* Hew. (Indian Gardens 24-vii-34 Bell; Hermit 4-vi-42 Garth; Roaring Springs 9-vii-47 Garth)

THE ORANGE SKIPPERLING flies in the Coachella Valley of California, as well as in western Arizona, its range extending into Baja California and Sonora, Mexico. Western lepidopterists are well acquainted with this small skipper, the color of which blends so perfectly with desert sand. It has been reared on Bermuda grass.

588. *Hesperia juba* Scud. (N. Rim 14-vi-38 Schellbach; Yavapai 3 to 6-ix-43 Schellbach; Transept 19-viii-46 Garth; Royal 18 to 21-viii-46 Garth)

THE JUBA SKIPPER has a green underside, against which a zigzag white band stands out in bold outline. It flies in California and Nevada, as well as in Utah and Colorado. It is found at Grand Canyon along the edge of the Transept at the North Rim and at Yavapai Point on the South. The first specimen above was determined by J. F. G. Clark, the Yavapai specimens by W. D. Field.

590.1 *Hesperia pahaska* Leuss. (Hermit 4-vi-42 Garth; Shoshone 28-vi-44 Schellbach)

THE PAHASKA SKIPPER is an orange-brown species devoid of green on the under side. To date it has been found only on the canyon's south wall and rim. The Shoshone specimens were determined by W. D. Field.

forma *williamsi* Linds. (Hermit 4-vi-42 Garth; Bass 6-vi-42 Garth; East Rim Drive 10-vi-42 Garth)

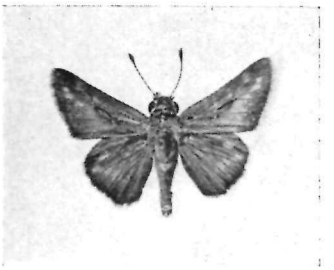

Fig. 23. *Hesperia pahaska*, male.

WILLIAMS' SKIPPER is a light form of the above species which at first glance appears to be merely a faded *pahaska*. Closer inspection, however, shows the yellowish specimen to be fresh and bright. It is probably an adaptation to the more arid portions of the Grand Canyon.

601. *Hylephila phylaeus* Dru. (Supai 4-viii-38 Bell)

THE FIERY SKIPPER ranges throughout the lowlands of tropical and temperate North and South America. The male is yellow, the female brown. Grasses are the chosen food plants, ordinary Bermuda grass being one.

604a. *Ochlodes sylvanoides napa* Edw. (N. Rim 18-vii-38 Bell; N. Rim 20-viii-42 Bryant; Greenland Spring 16-viii-46 Garth; also Transept and Roaring Springs)

THE NAPA SKIPPER is a Colorado form found commonly on the Kaibab Plateau. The identification is by E. L. Bell, who obtained the first Grand Canyon specimens. J. A. Comstock identified the Bryant specimen above as *O. sylvanoides* Bdv.

608. *Ochlodes yuma* Edw. (Indian Gardens 24-vii-34 and 18-vii-38 Bell)

THE YUMA SKIPPER is a resident of the hot Colorado River Valley and adjacent desert regions of California, Arizona, Nevada, and Utah. The unusual topography of the Grand Canyon brings together in *O. napa* and *yuma* species which normally fly in Colorado and near the Mexican border. Its large size and pale yellow coloration will serve to distinguish it from other species.

616. *Polites draco* Edw. (N. Rim 10 to 12-vi-42 Wasem; Neal 5-vii-47 Garth; Kanabownits 4 to 8-vii-47 Garth; also Checking Station and Swamp Ridge)

THE DRACO SKIPPER is an early flier at the North Rim, specimens taken in the first week of July being already worn. Checking Station Meadow, elevation 9,000 feet, is perhaps the best locality for this Colorado species, which flies about the sink holes characteristic of the region. It is also found on high mountain peaks of Arizona and New Mexico. Holland mentions specimens from White Horse and Yukon, Alaska.

626. *Poanes taxiles* Edw. ("Grand Canyon" 23-vii-34 Bell; S. Rim 18-vi-41 Schellbach; Hermit 7-vi-42 Garth; Neal 4-vii-47 Garth; also Aspen Glen, Greenland Spring, Roaring Springs, and Royal)

THE TAXILES SKIPPER occurs throughout the Rocky Mountain states from Nebraska through Colorado to New Mexico and Arizona. It is a large species, the males yellow bordered with brown, the females predominately brown. *Taxiles* was common at a point 1.6 miles below the North Rim in Roaring Springs Canyon, along the Kaibab Trail.

642. *Atrytone ruricola* Bdv. (N. Rim 18-vii-34 Bell; Cliff Springs 28-vii-45 Schellbach; Royal 7 and 19-vii-47 Garth)

THE DUN SKIPPER is as plainly marked a brown butterfly as one could encounter. It ranges widely throughout North America, specimens from different parts of the country varying considerably. The Bell specimen is in the collection of the American Museum of Natural History. The Cliff Springs specimens were determined by W. D. Field of the U. S. National Museum. (Note: This is not the *ruricola* of Comstock and other authors, which has been renamed *lindseyi* Holland.)

646. *Atrytonopsis deva* Edw. (Hermit 12-vi-42 Garth)

Fig. 24. *Atrytonopsis deva*, male.

THE DEVA SKIPPER is an Arizona species which also occurs in Utah and southern Colorado. A brown species with a white fringe, it was discovered when the writer returned to Hermit Basin in the hope

of finding more of the following species. The identification was made with the help of the Los Angeles Museum collection. Early stages of the insect are unknown.

649. *Atrytonopsis python* Edw. (Hermit 4-vi-42 Garth)

THE PYTHON SKIPPER is more restricted in range than the former species, being found only in Arizona. It is also a brown species, but with more white spots in the primaries than *deva* and with a checkered fringe. It is locally and seasonally abundant. Lloyd Martin of the Los Angeles Museum assisted with the identification. The food plant of the species is not known.

MEGATHYMIDAE (THE YUCCA BORERS)

687. *Megathymus streckeri* Skin. (Yavapai 5-vi-42 Garth; Yavapai 10-vi-43 Schellbach)

Fig. 25. *Megathymus streckeri*, male.

THE YUCCA SKIPPER which flies at the South Rim of the Grand Canyon is believed to be *M. streckeri*, although Skinner's type was doubtfully from Arizona, according to Barnes and McDunnough (Contrib. Nat. Hist. Lepid., 1[3] : 36, 1912), and compares well with specimens from southern Colorado. The specimen collected by the park naturalist at Yavapai station was identified by W. D. Field. Undoubtedly the skipper feeds upon one of the Park's three species of *Yucca*, rather than upon the single species of *Agave*, *A. utahensis*, but which of the three will be determined only after careful life history studies have been made. Members of the family Megathymidae are notoriously swift fliers, and the capture was accidental in each case.

COLLECTORS

The following persons have contributed to this study either by depositing duplicate specimens in the collection of the Naturalist Workshop or by allowing the writer to examine specimens which they collected at the Grand Canyon. Exact localities and years during which collecting was accomplished are given where known.

Adams, P.	Swamp Point, Royal, 1947.
Arnberger, L.	River, 1945; Neal, Hull, 1946.
Bell, E. L.	Phantom, Indian Gardens, Supai, N. Rim, 1934; N. Rim, 1935; Supai, 1936; Supai, Indian Gardens, 1938.
Bill, J.	Village, 1943.
Bryant, H. C.	N. Rim, S. Rim, 1942; N. Rim, B. A. Point, 1944; Phantom, Village, 1945; N. Rim, 1946 and 1947.
Carswell, D. F.	B. A. Trail, 1946.
Cox, G.	Village, 1940.
Davis, L.	Indian Gardens, 1931.
Duncan, D. K.	Indian Gardens, 1928 and 1929; B. A. Trail, 1929.
Hewes, L. I.	Royal, 1930, 1940, and 1945; Phantom (Year ?).
Lutz, F. E.	N. Rim, 1934.
McKean, W.	N. Rim, 1935.
McKee, E. D.	S. Rim, 1935.
Nabokov, V.	B. A. Trail, 1941.
Ricco, J.	N. Rim, 1937.
Rockefeller, D.	Supai, 1931; Supai, Phantom, 1934.
Schellbach, L.	N. Rim, S .Rim, 1938; N. Rim, 1939; N. Rim, Yavapai, 1940; S. Rim, 1942; B. A. Trail, Yavapai, 1943; Yavapai, 1944; Two River, Far View, Kanabownits, Cliff Springs, 1945; Village, 1946; Royal, Cliff Springs, Greenland Lake, Village, 1947.
Schultz, E. & S.	Neal, Royal, 1946.
Sturm, P.	Indian Gardens, 1946.
Tillotson, G.	S. Rim, 1934.
Tinkham, E. R.	N. Rim, 1947.
Wasem, D.	Far View, Neal, S. Rim, 1942.
Watson, W. A.	Village, 1935.
Williamson, R.	Village, 1932.

LOCALITIES

Following the practice of entomological reports of similar nature, a standard set of abbreviations has been adopted for localities within the park at which collections have been made. For convenient reference these are alphabetized under two headings, North and South Rims, the former including all localities north of the Colorado River. Elevations are taken from topographical sheets of the U. S. Geological Survey and are accurate to within a few feet in the case of promontories along the canyon rim, where bench marks are located. Directions for reaching all but the most obvious localities are given, and an attempt is made to characterize each according to Life Zone. Numbers correspond with those on the insert map of Grand Canyon.

North Rim

1. *B. A. Point:* Bright Angel Point, el. 8153 ft., see *Transept* below.

2. *Checking Station:* Checking Station Meadows at the north entrance to the Park, a typical alpine meadow; el. 9100 ft.; Hudsonian elements present.

3. *Cliff Springs:* Cliff Springs on the Walhalla Plateau, reached by a short trail from the North Rim drive just before it ascends Cape Royal; el. 6700 ft.; Upper Sonoran Zone.

4. *Far View:* Farview Point on Walhalla Plateau; el. 8428 ft.; Canadian Zone, with Upper Sonoran infiltration.

5. *Greenland Lake:* A small pond located along the North Rim-Cape Royal drive at the point of its ascent on to the Walhalla Plateau; el. 8450 ft.; Canadian Zone.

6. *Greenland Spring:* Lower Neal Spring, a watering trough situated at the point at which Neal Canyon drops off into the Grand Canyon proper; el. 8000 ft.; Canadian Zone with Upper Sonoran infiltration.

7. *Harvey:* Harvey Meadows, located just south of the highway turnoff to Point Imperial and Cape Royal and at the base of the mile-long projection of the North Rim which includes Bright Angel Point; el. 7850 ft.; Canadian Zone.

8. *Kanabownits:* Kanabownits Spring, situated in Kanabownits Canyon on the road to Point Sublime; el. 7938 ft.; Canadian Zone. The same designation includes all of Quaking Asp Canyon to Tipover Springs, el. 8200 ft.

9. *Muav:* Muav Saddle, separating Swamp Point and Powell Plateau. Reached by fire road from Kanabownits Spring via Tipover Spring and

Swamp Lake. El. 6717 ft.; Upper Sonoran Zone with weak Transition elements.

10. *Narrows:* The narrow neck of land separating Walhalla Plateau from the North Rim proper; el. 8500 ft.; Canadian Zone, with Upper Sonoran infiltration.

11. *Neal:* Upper Neal Springs, a public camp ground less than a mile south of the Point Imperial turnoff from the North Rim-Cape Royal drive. A grassy draw between aspen and fir forest; el. 8175 ft.; Canadian Zone.

12. *N. Rim:* North Rim, used as a specific designation on the assurance of the park naturalist that specimens collected by him bearing this label were secured in the immediate vicinity of Bright Angel Point and the administration area. El. 8153-8250 ft.; Canadian Zone with Upper Sonoran infiltration. See also *Transept.*

13. *Phantom:* Phantom Ranch, located in Bright Angel Canyon just above its confluence with the Grand Canyon proper; el. 2550 ft.; Lower Sonoran Zone.

14. *Powell:* Powell Plateau, reached by fire road to Swamp Point, then by trail over Muav Saddle. A 60,000 acre area of which only the east end was collected. El. 7555-7650 ft., the former that of Dutton Point. Upper Sonoran to Transition Zone.

15. *Royal:* Cape Royal, reached by the North Rim drive from Grand Canyon Lodge. Best example of an exposed North Rim area. Pinyon-juniper association with five species of cactus present. El. 7876 ft.; Upper Sonoran Zone with Lower Sonoran infiltration.

16. *Roaring Springs:* Roaring Springs Canyon, through which the Kaibab Trail first passes on its descent from the North Rim. Gambel oak and locust association. El. 4750-8150 ft.; Upper Sonoran to Canadian Zone.

17. *Robbers Roost:* Robbers Roost Spring and Meadow, reached by short trail from Lindbergh Summit on the main highway into the Park. El. 8200 ft.; Canadian Zone.

18. *Sublime:* Point Sublime, reached by rustic road from turnoff near Checking Station. An exposed area similar to Royal and even more extensive. El. 7464 ft.; Upper Sonoran Zone.

19. *Swamp Lake:* A stagnant pond located on Swamp Ridge four miles from Swamp Point; el. 7750 ft.; Canadian Zone.

20. *Swamp Ridge:* The ridge leading from Swamp Lake, el. 7750 ft., to Swamp Point, el. 7522 ft., and showing in a four mile distance transition from fir through yellow pine to Gambel oak. Canadian to Upper Sonoran Zone.

21. *Tipover:* Tipover Spring, situated at the head of Quaking Asp Canyon, which leads north from Kanabownits Spring; el. 8200 ft.; Canadian Zone.

22. *Transept:* Transept Trail, leading from Bright Angel Point, el. 8153 ft., to the North Rim camp ground and administrative area, el. 8250 ft. This designation has been used in preference to Schellbach's *N. Rim* by the writer in listing specimens taken by himself on the mile-long peninsula culminating in Bright Angel Point. Canadian Zone with strong Upper Sonoran infiltration.

23. *Two River:* Two River Junction, a view point on the North Rim-Cape Royal drive from which the union of the Colorado and Little Colorado Rivers may be seen. El. *ca.* 8000 ft.; Canadian Zone with Upper Sonoran infiltration.

South Rim

24. *Aspen Glen:* A grove of Quaking Aspen trees situated in a draw 16 miles east of Grand Canyon Village; el. 7450 ft.; Canadian Zone.

25. *Bass:* Rowes Well Road about two miles west of Bass Station on the A. T. & S. F. R. R.; el. 6211 ft.; Transition Zone with strong Upper Sonoran infiltration.

26. *B. A. Trail:* Bright Angel Trail, descending from a point near Grand Canyon Village, el. 6866 ft., to the River Colorado, el. 2250 ft. Because of the great range in elevation and of life zones, this designation has been avoided wherever possible. Most specimens so labeled were taken a short distance below the South Rim, in Upper Sonoran Zone, although the trail below Indian Gardens is Lower Sonoran.

27. *Grandview:* Grandview Point, located on the East Rim drive; el. 7406 ft.; the tip of the point is Upper Sonoran Zone with Transition surrounding it.

28. *Havasupai:* Havasupai Point, reached by Rowes Well Road through Pasture Wash; el. 6750 ft.; Upper Sonoran Zone.

29. *Hearst:* Hearst Tanks, located just east of Grandview Point, and consisting of a few catch basins which usually contain water; el. 7400 ft.; Transition Zone.

30. *Hermit:* Hermit Basin, reached by trail from Hermit's Rest at the end of the West Rim drive; el. 5250 ft.; pinyon and juniper; Upper Sonoran Zone.

31. *Hopi:* Hopi Point, the first prominence west of Grand Canyon Village; el. 7071 ft.; Upper Sonoran Zone.

32. *Indian Gardens:* Indian Gardens, located on Bright Angel Trail

at the level of the Tonto Plateau; cottonwood and *Opuntia* cactus; el. 3750 ft.; Lower Sonoran Zone.

33. *River:* River Trail, joining Bright Angel and Kaibab Trails along the south bank of the Colorado River; el. 2250-2500 ft.; Lower Sonoran Zone.

34. *Shoshone:* Shoshone Point, the first promontory east of Yaki Point; el. 7250 ft.; Upper Sonoran Zone backed by Transition.

35. *Supai:* Supai, the Indian Village in Havasu Canyon, reached by trail from Hilltop at the end of the road which begins at Bass and continues through Pasture Wash; el. 3201 ft.; Lower Sonoran Zone.

36. *Village:* Grand Canyon Village, site of Park Administration, El Tovar Hotel, Bright Angel Lodge, and terminus of A. T. & S. F. R. R.; el. 6866 ft.; Transition Zone.

37. *Yaki:* Yaki Point, located three miles east of Grand Canyon Village and one mile north of the East Rim Drive. South Rim terminus of the trans-canyon Kaibab Trail. El. 7250 ft.; Upper Sonoran Zone.

38. *Yavapai:* Yavapai Point, one mile east of El Tovar Hotel, easily reached by trail along the canyon rim. Continuing on this trail another mile one comes to a burned over area from which pinyon pines are absent and which affords some of the best collecting to be had in the vicinity; el. 7050 ft.; Upper Sonoran Zone.

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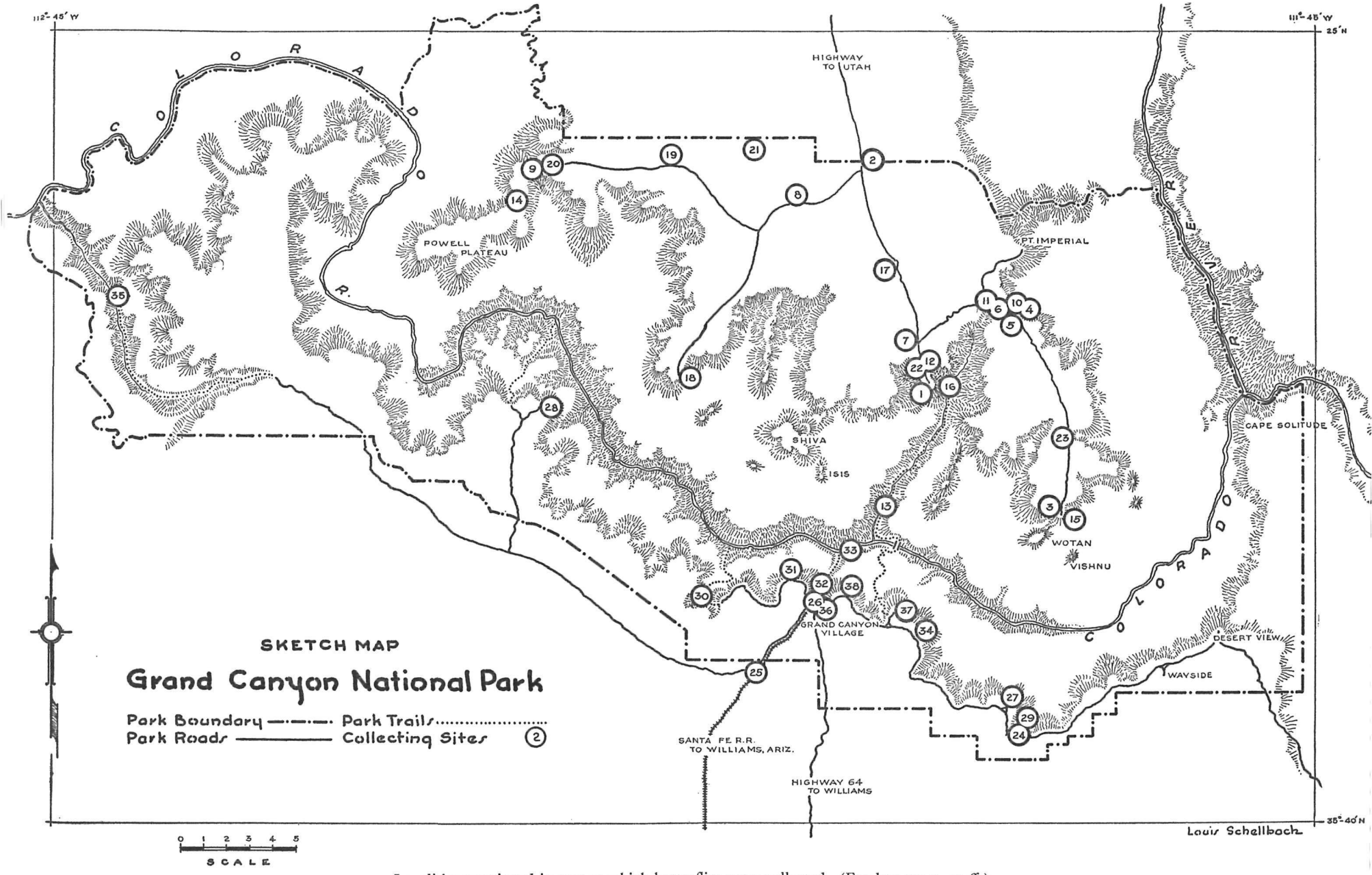

Localities mentioned in text at which butterflies were collected. (For key see p. 45 ff.)

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