

UNIVERSITY OF MONTANA
BULLETIN No. 30
BIOLOGICAL SERIES No. 10

The Butterflies of Montana

With Keys for Determination of Species
by

Morton John Elrod, Ph.D.,

Professor of Biology, University of Montana, Director of
University of Montana Biological Station,

ASSISTED BY FRANCES INEZ MALEY, A.B.

A Nature Study Bulletin, for the use of Teachers,
Students and others who wish to study the Butterflies;
with one colored plate, twelve plates in black and
white, and one hundred and twenty-five figures.

UNIVERSITY OF MONTANA,
Missoula, Montana, U. S. A.
January, 1906.

Entered August 24, 1901, at Missoula, Montana, as second class matter, under
act of Congress July 16, 1894.

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The University of Montana.

TO THE BOYS AND GIRLS OF MONTANA, WHO
DELIGHT IN ROAMING THE HILLS OR IN FOLLOW-
ING THE BANKS OF THE STREAMS.

EXPLANATION OF PLATE I.

Fig. 1. *Oeneas chryxus*, Doubleday and Hewitson, showing lower surface.

Fig. 2. Upper surface of *Lemonias chalcon*, Doubleday and Hewitson.

Fig. 3. Upper surface of *Phyciodes mylitta*, Edwards.

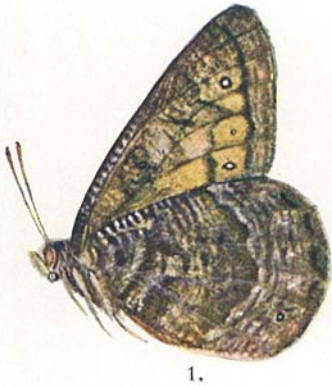
Fig. 4. Upper surface of male *Chalceria rubidus*, Edwards.

Fig. 6. Lower surface of *Cercyonis sylvestris*, var *charon*, Edwards.

Fig. 6. Lower surface of *Thecla acadica*, Edwards.

From water color drawings by Mrs. Edith Ricker.

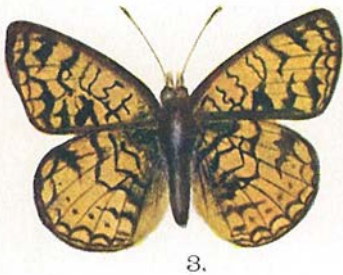
All figures enlarged about one-third.



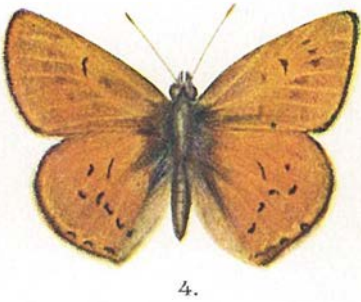
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Preface.

In preparing some Nature Study work for teachers it became apparent that teachers have little to work on in this region to enable them to prepare studies on butterflies. It was really to assist teachers and others in identifying specimens that this bulletin was prepared. It is hoped that it will meet the needs of teachers and be of material assistance to them. The boys and girls of the state have little to assist them in the study of natural history specimens of the state, since the books which would be serviceable are either too expensive or too voluminous to handle. If the study of the butterflies is stimulated in the coming generation the writer will feel amply repaid.

Full credit for most of the assistance rendered has been given in the Introduction. Mrs. C. A. Wiley, of Miles City, has very kindly placed at our disposal a copy of Edwards' *Butterflies of North America*, with colored plates. Supt. P. M. Silloway of Lewistown, has rendered material aid in collecting specimens at Swan lake. The glossary has been prepared by Josiah J. Moore, of Anaconda, a student at the University of Montana. The index has largely been prepared by my wife.

I offer no apology for making some of the descriptions much longer than others. Some of these are totally inaccessible to hundreds of those who will use this work. A lengthy description of a species that will be difficult of determination will be of great service to the young student. Where the specific characters are easy of determination and good photographs are supplied the descriptions are brief.

After the matter was all in type a list of butterflies was received from Prof. Ezra Allen, of the State Normal at Dillon, which specimens have been incorporated in the work. The information in this bulletin includes reference to specimens collected in the eastern end of the state at Miles City, the central portion at Bozeman, the southern part at Aldridge and Dillon, the main Rocky Mountain region at Helena, the western slope at Missoula and Flathead Lake.

Nov. 1, 1905.

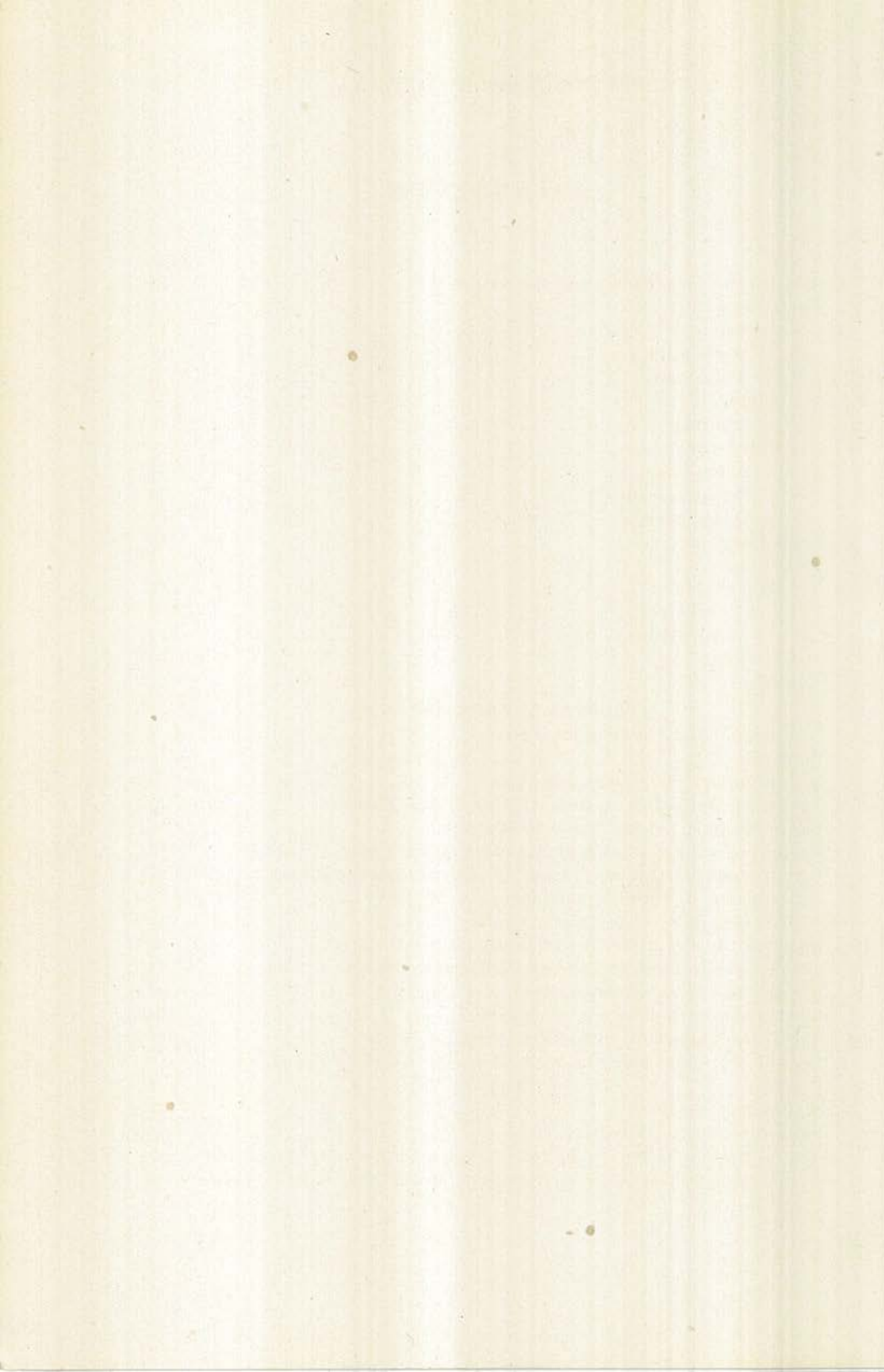
M. J. E.

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The Butterfly.

I hold you at last in my hand,
Exquisite child of the air;
Can I ever understand
How you grew to be so fair?

You came to this linden tree
To taste its delicious sweet,
I sitting here in the shadow and shine
Playing around its feet.

Now I hold you fast in my hand,
You marvelous butterfly
Till you help me to understand
The eternal mystery.

From that creeping thing in the dust
To this shining bliss in the blue!
God, give me courage to trust
I can break my chrysalis too!

—Alice Freeman Palmer.

Introduction.

The present bulletin is the result of eight years of collecting and tabulating material. My first butterflies captured in the state were taken at Miles City in the east and Mount Lo Lo in the west during a recreation trip in August, 1892. In 1897 I came to the state to live. Every summer since then to the present time has been spent in the field, and the accumulated insects have been arranged at the University of Montana, where they have been worked over at leisure moments.

In the fall of 1900 Miss Frances Inez Maley was given the task of spreading, arranging and labeling the material, identifying it so far as possible with the specimens and literature at command. A large portion of her time for that school year was devoted to the work. The collection of more than a thousand specimens was spread and arranged in Comstock cases. A large number of the photographs were taken at that time, others later. Many of the keys and descriptions were prepared by her, and the results of her careful and painstaking labor were submitted to the faculty as her graduating thesis for the degree B. A. in June, 1901.

As it was impossible then to correct and verify as must necessarily be done before printing, it was decided to test the keys and make further addition to the list by including references to all the collections available in the state. For several summers the keys have been in the hands of many persons both at the University in regular work and at the University of Montana Biological Station at Flathead lake. In this way many errors have been avoided, and the keys have been found to be serviceable in the hands of beginners. Moreover, by the examination of other collections many additions were made, necessitating changes in the keys and in the text. Many of the descriptions were rewritten.

To avoid confusion it was decided to follow the nomenclature used by Dyar and others in Bulletin 52, United States National Museum. In this bulletin many species recorded in other publications are reduced to synonyms or varieties of other species. After examining so many hundreds of specimens from various parts of the state, at different altitudes, I feel convinced that the list can be reduced still further without detriment, and without sacrificing. To cite a single illustration. The Wiley collection has specimens of *Argynnis* from Miles City, collected in 1893, and identified by Edwards as *A. edwardsi*. Specimens from Miles City sent by myself to Edwards in 1892 were labeled *A. nevadensis*. When placed side by side they look exactly alike, and are undoubtedly of the same species.

Owing to the varying conditions as to heat and cold, moisture and sunshine, which prevail in the state, many species are subject to great variation. This makes identification oftentimes difficult, and we have

often been greatly puzzled. As a result of these great variations, combined with the mistakes one is likely to make in undertaking a task like this so far from library centers and large collections, we feel that we have certainly made many errors, of which we are now not aware. We have at least brought together the material in the state and have brought it into some kind of order for students of butterflies later to make more perfect. The task has been all the more difficult because the state contains specimens from the Great Plains region, from the Pacific coast region, and from the Boreal fauna in the north.

The collections examined and recorded in this bulletin are the following: (1) The collection made by the writer, almost entirely in the museum of the University of Montana, made during the past eight seasons of collecting. These have been taken mostly in the western end of the state. The numbers of specimens in the collection has not been determined, but there are many thousand. (2) George E. Barnes, a graduate of the University, made a collection of several hundred in the vicinity of Aldridge, in the southern part of the state near the Park. These were generously donated by him to the University. (3) E. N. Brandegee, of Helena, made a collection of several hundred specimens in the vicinity of Helena in 1902. These he very kindly placed at the disposal of the writer for examination and study. (4) The late C. A. Wiley, of Miles City, made an extensive collection of Lepidoptera in eastern Montana during his several years of residence in Montana. This collection came to the University entire, and has been gone over carefully. (5) The collection at the Montana College of Agriculture and Mechanic Arts at Bozeman, the work of Professor R. A. Cooley, was very kindly placed at my disposal by Prof. Cooley. This contains a good series of insects, excellently mounted, and in some cases from high altitudes. Eugene Coubeaux, of Big Sandy, made a collection during the summers of 1904 and 1905, and very kindly loaned specimens for examination. He also furnished notes regarding the abundance of each species. These five collections practically represent the butterfly collections in the state. They contain specimens from the extreme east and west, and from the south. The great section of country tributary to the Missouri river in the northeast is not represented, nor is the extreme north in the Rocky Mountains. Other authors have been referred to and quoted freely.

The illustrations are almost entirely original. The colored plate is the result of the work of Mrs. Edith Ricker, of Burlington, Iowa, who has spent three summers at the Station at Flathead. Colored drawings were made from specimens and the colored drawings were made into the printed plate by the three color process. It is to be regretted that the expense precluded more generous use of colored plates, instead of the half tones. Many of the drawings were also made by Mrs. Ricker and her brother, Lisle W. Brown, now in connection with the Eastman Kodak Company, including all of the figures of wing venation, except a few made by Claude Spaulding, laboratory assistant at the University. The photographs of butterflies were made by Miss Maley, Mr. Spaulding and the writer. Other photographs used have appropriate credit given with each.

Without the generous aid of these friends, who gave their work cheerfully and gratuitously, these original illustrations would be lacking.

We are deeply indebted to President Craig, of the University, for the cordial support he has given us in our efforts to popularize this subject and make the study available to the younger generation of the state. His liberal policy has enabled us to use copious illustrations, and any plan for better results or for increased usefulness of publications has always met with his hearty favor.

The pleasure we have found in the preparation of the material for publication has been ample compensation for the labor. We can wish for those who peruse it or read it no more enjoyment in its use than has been ours in gathering the specimens and bringing them together. Every specimen which we have gathered recalls some scene, whether it be the jagged sky line of the back bone of the continent as viewed from the Swan range when we were sweeping in a few *Phyciodes*, a battered *Eurymus alexandra*, or the various species of *Argynnis*, or the quiet and peaceful woods adjacent to the laboratory at Flathead lake. Again, as we pick up *Satyrus olympus* or *Brenthis myrina* we are reminded of the dusky faces on the Flathead reservation and the beautiful Mission valley, flanked by the majestic Mission mountains. *Vanessa californica* brings to us in winter the first breath of spring, as it is our earliest specimen, coming at Missoula in 1903, February 19. *Vanessa J. album* carries us to Swan lake, where the manical call of the loon is answered by the blood curdling shriek of the puma, while the water lap-laps the bottom of our boat as we head for the campfire on shore.

Beautiful, dainty, golden laced *Lycana melissa* carries us to Sinyaleamin lake, cradled in the mountains, where we spent such happy and care free days. *Oeneas chryxus* takes our memory to Mount Woody, south of Missoula, which we have ascended a dozen times for butterflies. Whichever way we turn, whatever insect we pick up, our memory brings to us days of happiness and pleasure.

M. J. ELROD,
University of Montana.

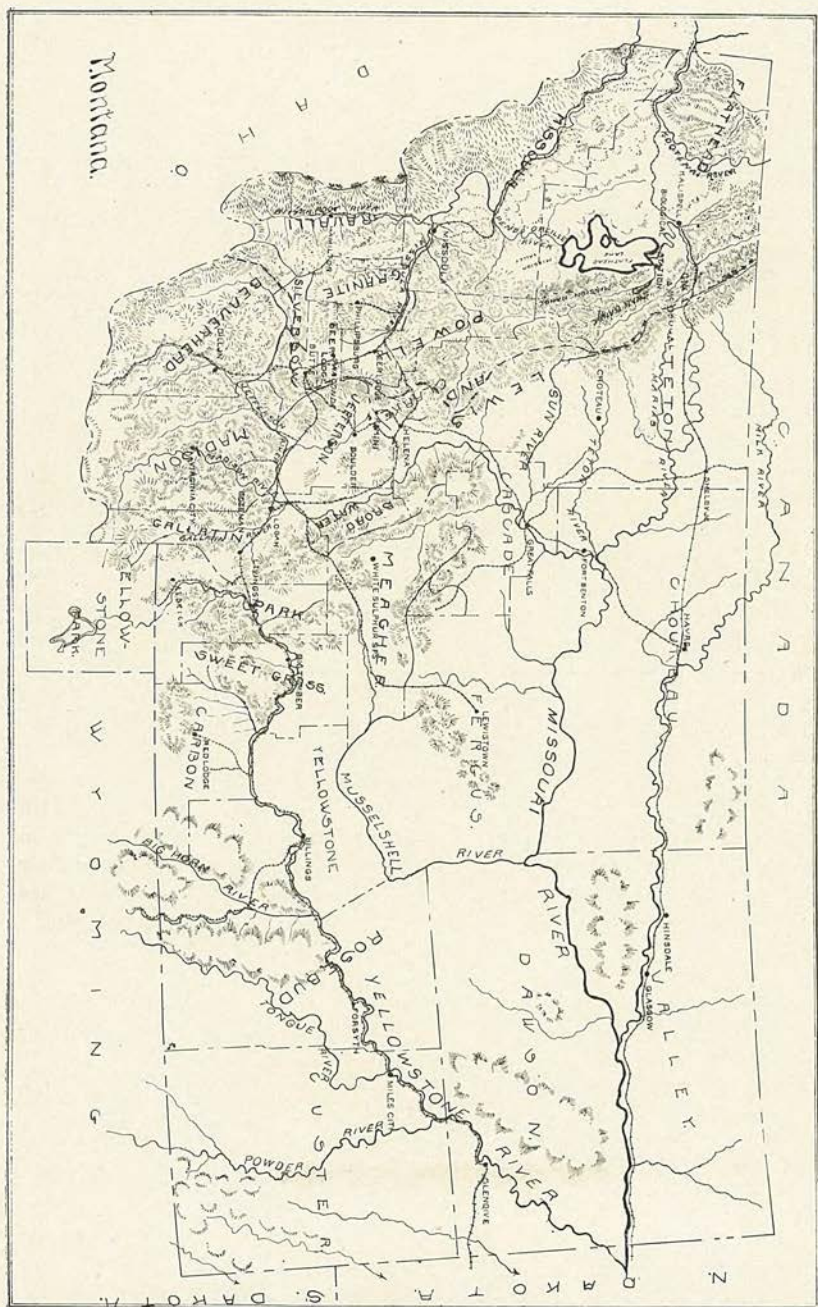
Montana.

Montana lies between the parallels of 49 degrees and 44 degrees 15 minutes north latitude, and extends from 104 degrees to 116 degrees west longitude. The form of the state is nearly a parallelogram, being about 540 miles in length with an average width of 275 miles.

The surface of the state is generally mountainous. The main range of the Rocky mountains, with numerous spurs, traverses the western part in a direction northwest to southeast; between these are many beautiful and extensive valleys, which cover nearly three-fourths of its area. The northeastern fourth is a high, rolling prairie country, covered with nutritious grasses. A considerable portion of the country between the Missouri and Yellowstone rivers is occupied by the Mauvaises Terres.

The average elevation of the surface is about 4,000 feet above the level of the sea. The elevation of the eastern third of the state is less than 3,000 feet, while that of the mountains and foothills in the western part of the state is from 4,000 to 10,000 feet. The highest peak is above 12,000 feet. The surface rises westward at the rate of about eight feet per mile.

This state has extremes of climate. Many sections of the state experience severe northern blizzards, others have delightful summers, still others hot deserts. Lovely lakes lie in the north, dry treeless plains in the east, almost devoid of vegetation. The western slopes with their copious rainfall afford a climate moist and warm. To the south are mountains capped with snow. Between these are many grand canyons.



Map of Montana, showing geographical areas, and localities where collections have been made.

Collecting and Preserving Specimens.

In collecting butterflies a net is necessary, and some means of killing them after capture.

The simplest form of the net, which can be made almost anywhere, is constructed as follows: A rod of some light stiff material is used as the handle, not more than five feet in length. Attached to this at its upper

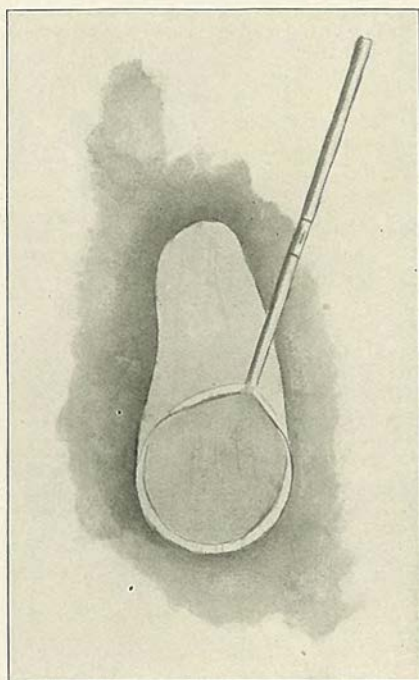


Fig. 1. A butterfly net.

A silk bag is desired. A silk bag has many advantages. It dries readily when wet, requiring but a few swishes through the air. It may be swept through the air with much greater speed than any other net. It does not snag readily, and has a much longer life.

The specimens collected are killed in some way that shall not mutilate them. A very convenient way is by means of the cyanide bottle, which is prepared in the following manner: Take a wide mouthed bottle holding four or six ounces. Put in the bottle a piece of cyanide of potassium about three-fourths of an inch square or a table spoonful of

end is a loop or ring made of metal or some moderately stiff yet flexible material. Upon this then should be sewed a bag of fine netting, preferably tarlatan, almost thirty inches deep; the ring should be not less than a foot in diameter.

Several forms of folding nets are on the market by dealers in entomological supplies. These nets are detachable from the handle, and will fold in two or more pieces. They may thus be tucked in a pocket or packed in with baggage without injury, to be drawn out and speedily adjusted when necessary. Handles may also be purchased which fit together in sections, and are likewise easily transported and quickly adjusted. See Fig. 1.

Nets may be purchased with

the pulverized, and water enough to cover the cyanide and then, immediately before there is time for the cyanide to dissolve, put enough plaster of Paris in the bottle to soak up the water. Cut a paper as in Fig. 2 to cover the plaster. The bottle should then be left open in a shady place for an hour to dry and then securely corked and labeled "Poison." See Fig. 3.

Fig. 2. Paper cut for cyanide bottle.

left in over night without injury.

Another method of killing the insect is to enclose a piece of cotton, upon which a few drops of chloroform, sulphuric ether or benzene has been put, with the insect to be killed, in a small bottle or small box.

Still another method of killing is to entangle the insect in the meshes of the (silk) net, with wings over the back, and give a quick but hard squeeze on the sides of the thorax. This may do some injury to the insect by rubbing off some scales, but in the absence of a killing bottle it may be necessary to kill a specimen or lose it.

Much of the success of the collector will depend upon his skill in the use of his net. No description of the method is worth anything besides a very little experience, and one soon learns to capture with dextrous turn of the hand, "practice makes perfect." It is possible to sweep into the net an insect which is fluttering through the air and by a turn of the hand to close the bag. One manner which is preferred by many is to clap the net over the butterfly and allow it to rise, and then insert the bottle in the net and without touching it allow it to drop into the bottle. If possible the fingers should never be allowed to come in contact with the wings.

Papering Specimens—When time and place do not suffice for the proper preparation of the butterflies, they may be placed in envelopes, until such a time as one is able to relax and properly mount them. The small dry envelopes are very good for this. The insect while in the net usually has its wings folded back. It may also be dropped into a triangular envelope made by folding a piece of paper as shown in Fig. 4, and a memorandum of the locality and date of capture is written on the envelope. They may then be packed in a shallow box, a cigar box being preferable.

When it is desired to pin and spread specimens that have been stored away they are relaxed. To do this take several large sheets of blotting paper, wet with water, place the papered butterflies on the sheets, then

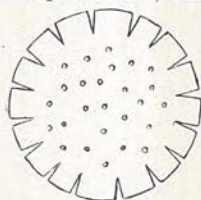


Fig. 3. Cyanide bottle.

wet two more sheets and place over these. Do this as often as there are insects to be covered. Let them remain here two or three days, at the end of which time they can be spread as easily as when fresh. Care must be taken not to leave the specimens here too long lest they become mouldy.

In spreading insects, the insect should first of all be pinned, the pin being thrust perpendicularly through the thorax, leaving about one-fourth of the pin to view. It should then be placed upon the setting-board. Setting-boards are two pieces of board slanted toward the inside. Many collectors prefer straight boards, with a piece of cork beneath, and a groove on the upper surface of sufficient depth to accommodate the body of the insect and to permit the wings to be brought to a level of the upper surface of the board.

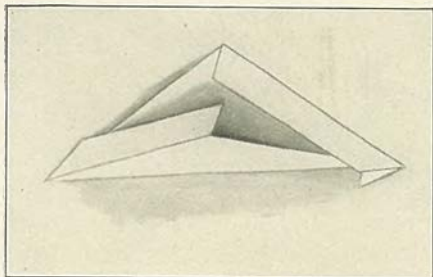


Fig. 4. Folded paper for insects.

When the insect has been pinned upon the board the next step is to set the wings in the position which they are to maintain when the specimen is thoroughly dry.

In bringing the wings into position, care should be taken to put the pin behind the strong nervure, on the costal margin of the wing; otherwise the wings are liable to be torn and disfigured. The rule is to draw the anterior wing forward in such a manner that the posterior margin of this wing is at right angle to the axis of the body, the axis being a line drawn through the head to the extremity of the abdomen. The hind wing should then be moved forward, its anterior margin lying under the posterior margin of the fore wing. When thus arranged slips of paper should be drawn over them and securely pinned to keep them in position, and the pins removed from the wings. Never pin through the wing. Next the antennae should be adjusted, and placed parallel with the wings, and fine pins placed about them to hold them in position. Then if the body has a tendency to droop it should be raised by placing pins under it on either side. See Fig. 5.

When insects have been spread the board should be placed where they will be unmolested and free from dust. They should be left here for about a week, longer if the insect is very large, at the end of which time they may be taken off and put in the cabinet.

Labelling—Each specimen should have on the pin below the specimen a small label, giving the date of capture, if known, and the locality. Labels should be printed, or written in a fine hand, and preferably with India ink.

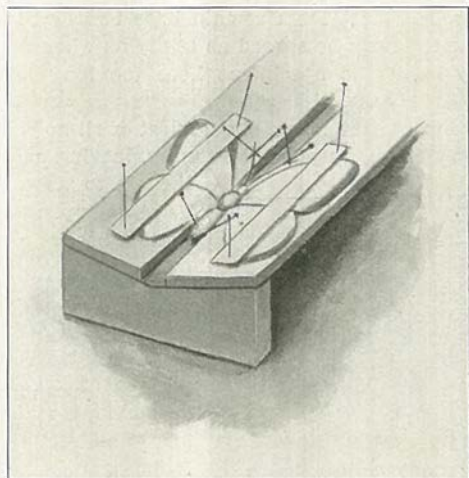


Fig. 5. Settling board, showing method of pinning and spreading insects for the collection.

Pins—The insect pins are made longer and thinner than ordinary pins.

Pins, pinning forceps, Fig. 6, printed labels, insect boxes and cabinets, sheet cork or peat, or other entomological supplies may be had of dealers in this material. A japanned steel pin is now on the market which is much superior to any pins heretofore made in that smaller pins may be used and still have greater stiffness and strength. For cabinets such pins are much more desirable, but at the same time are more expensive than ordinary pins.

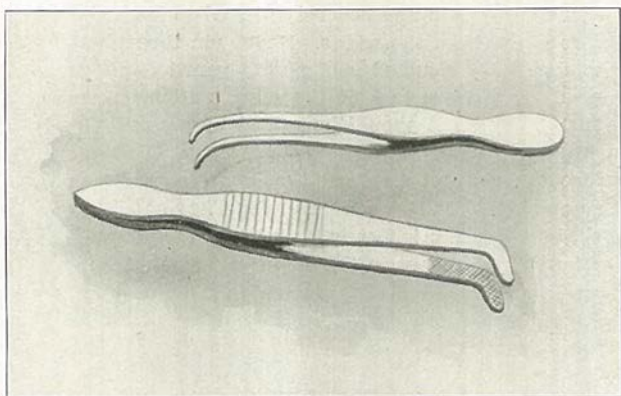


Fig. 6. Pinning forceps, for pressing pins into cork.

Venation of the Wings.

The thickened lines in the wings are termed the veins or nerves; and their arrangement is described as the venation or neururation of the wings. The thin spaces of the wings which are bounded by the veins are called cells. When a cell is not completely surrounded by veins it is said to be open.

The wings of different insects vary greatly in structure, but they are all more or less triangular in outline; they therefore have three margins; the costal margin or costa (a b); the outer margin b, c, and the inner margin c. a. The angle at the base of the costal margin and the outer margin is the apex of the wing; and the angle between the outer margin and the inner margin is the anal angle.

The principal veins of the wings are, beginning with the one lying on the costal margin, the costa, the subcosta, the radius, the media, the cubitus, and the anal veins. The radius media, and cubitus are usually branched and there may be several anal veins.

In some insects there are the premedia a vein lying between the media and radia; and a postmedia lying between the media and the cubitus.

| | | |
|-------------|--------------|---------|
| I Costa | V Media | VIII) |
| II Subcosta | VI Postmedia | IX) |
| III Radius | VII Cubitus | X) Anal |
| IV Premedia | | et al) |

By referring to Figs. 7-12 these veins may easily be studied. As many of the generic distinctions are based on the venation it is essential that the student become thoroughly familiar with the locations and numbering of veins of wings.

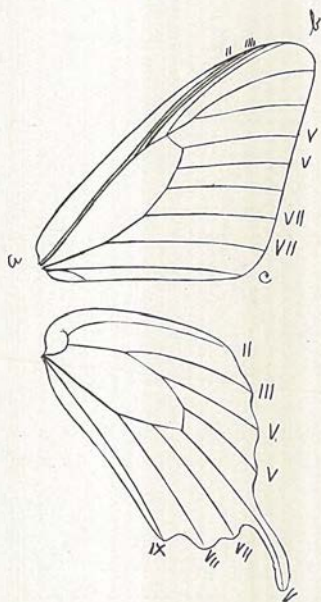
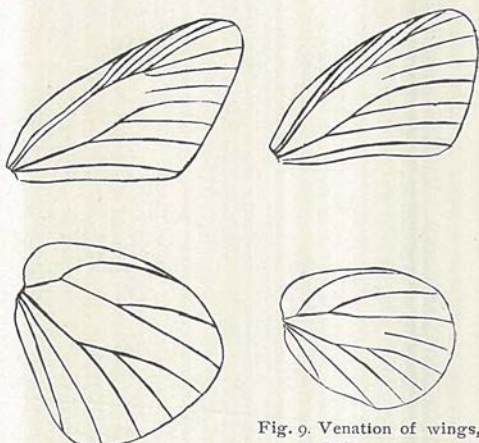


Fig. 7. Venation of wings, Papilionidae.

Fig. 8. Venation of wings,
HesperinaFig. 9. Venation of wings,
Lycaenidae.Fig. 10. Venation of wings,
Pieridae.Fig. 11 Venation of wings,
Nymphalidae, *Argynnis leto*.Fig. 12. Venation of *Parnassius*.

Key for Determation of Butterflies.

1. Antennae thread-like with a knob at the extremity.—2.
2. With the radius of the fore-wings five-branched, Fig. 8, and with all the branches arising from the discal cell; club of antennae usually terminated by a recurved hook. The Skippers. Hesperina, page 142
3. With some of the branches of the radius of the fore-wings coalesced beyond the apex of the discal cell, Fig. 7; club of antennae not terminated by a recurved hook. Butterflies. Papilionina, page 13

SUPERFAMILY PAPILIONINA.

Key to Families.

1. Cubitus of the fore-wings apparently four-branched, Fig. 7.
Papilionidae. P. 13
- Cubitus of the fore-wings apparently three-branched, Fig. 11.—2.
2. With six well developed legs, although in some species the fore legs of the male are a little shorter, and the tarsi of these lack one or both claws; radius of the fore wings, with rare exceptions, only three or four-branched. To determine the number of branches of radius, count the two cubital and the three medial branches first; the branches left between veins V and II belong to the radius.—3.
- With only four well developed legs, the fore legs being unused, much shorter than the others, and folded on the breast like a tippet (except in the female of *Hypatus*). Radius of fore wings five-branched, Fig. 11.
Nymphalidae. P. 44
3. Vein V of the fore-wings arising at or near the apex of the discal cell, Fig. 9, except in *Feniseca tarquinius*, in which the wings are dark brown, with a large fulvous spot on each. Lycaenidae. P. 124
- The first branch of media of the fore wings united with the last branch of the radius for a considerable distance beyond the apex of the discal cell. Fig. 10. Ground color of the wings white, yellow or orange.
Pieridae. P. 26

FAMILY PAPILIONIDAE.

Key to the Subfamilies.

- Hind wings with a tail like prolongation; ground color of wings black; radius of fore wings five-branched; the base of vein VIII of fore wings preserved as a spur like branch of vein VII, Fig. 7.
Papilioninae. P. 19
- Hind wings without tail like prolongation; ground color of wings white; radius of fore wings four-branched; vein VIII of fore wings wanting, Fig. 12.
Parnassiinae. P. 13

SUB-FAMILY PARNASSIINAE.

The Parnassiinae differ from the Papilioninae in lacking the tail-like prolongation of the hind wings and in that the ground color of the wings

is white, but resemble them in possessing similar scent organs in the larval state. They are found only on high mountains or far north.

Key to Genera.

Medium size, diaphanous wings, white or yellow in color, marked with black spots and round pink or yellow spots margined with black.

Parnassius.

Genus PARNASSIUS, Latrielle.

Butterfly—Medium size, with diaphanous wings, generally white or yellow in color marked with black spots, and round pink or yellow spots. The head is relatively small, thickly clothed with hairs. The antennae are short and straight. The wings have a rounded apex. The upper radial is lacking.

Early Stages—The egg is turban-shaped. The caterpillars have very small heads. They are flattened and dark brown or black in color with light spots.

Key to Species.

Males with very light wings, black reduced to a row of marginal and sub-marginal lunules, the latter often lacking. Females with the whole upper surface of primarus smoky black. Antennae with black and white rings, black knobs. smintheus.

Males with darker wings, a sub-marginal row of white lunules. Females much like males, but darker. Antennae black. clodius

THE PARNASSIUS BUTTERFLY.

Parnassius Smintheus, Dbl. and Hew., var Hermodour. Fig. 13, Male;
Fig. 14, Female.

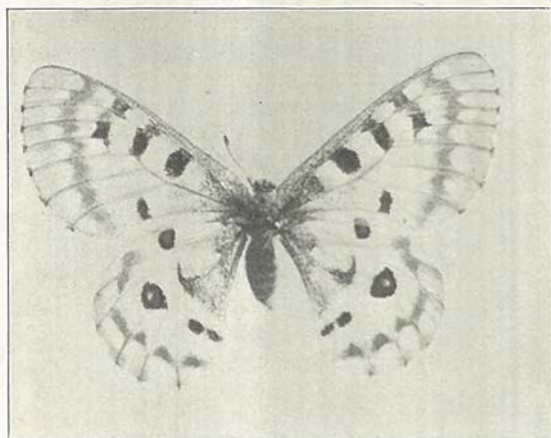


Fig. 13, *Parnassius smintheus*, var. *hermodour*, male.

Butterfly—This beautiful insect is subject to great variations. The expanse of the wings of the female is 2.25-3.00 in., male 2.00-2.50 in. The white ground is marked with smoky black to a greater or less extent. On the wings are yellow or pink spots, varying in size, margined

with black. There is a marked difference between the females and males, the latter being much whiter with the smoky black confined to the outer border of the wings and the inner edge of the hind wings. There is a black bar in the middle of the discal cell of fore wings, another at the outer end of the cell, beyond which is a more or less prominent bar with or without red spots (one or two). The female is much darker, with the whole upper surface of the primaries usually smoky-black hue, slightly transparent, the usual bands being lost in the ground color of the wing. Yellow or pink spots much larger than in the male.

The variety *hermodour* is much blacker than *smintheus*. Both are found in the state. Comparison of specimens from Montana with those from Pike's Peak show the latter to be much smaller, and lighter. As

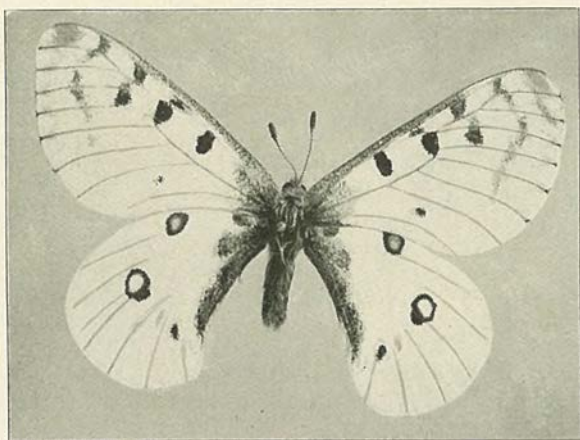


Fig. 14, *Parnassius smintheus*, var. *hermodour*, female.

the Pike's Peak specimens are from altitude 12,000 feet and Montana specimens from 3,000 to 7,000 this is to be expected.

These butterflies are truly Alpine, and fly for but a short season of the year. The lowest altitude at which they have been taken is about 3,000 feet near the Biological Station at Flathead lake. At Missoula they are rare, and have not been taken below 5,000 feet, and then in small numbers. They fly lazily but easily. Owing to the fact that they are usually taken at high altitudes their capture results in much fatigue. Often they sail gracefully over a cliff when the pursuer is all but ready for a sweep of the net. In the same locality high elevation seems to result in smaller and blacker specimens, low elevation in larger and whiter ones.

Distribution—The University collection contains specimens from Missoula, Tobacco Root Mountains, Mission Mountains, New Chicago, Madison Lake, Geyser Basin, Flathead Lake, the Swan Range and the National Park. It is found at higher elevations throughout the state, ranging from Colorado to California, Montana to New Mexico. Its northern limit is unknown. According to Edwards it has been taken as far

as Loggan, Alberta. Coubeaux has collected it at Sheep Creek near Big Sandy. He says it is not common in the Highwood and Little Belt Mountains, and that it seems to be absent from the Bear Paw Mountains.

Food—The caterpillar feeds on *Sedum* and *Saxifraga*. The butterfly is common in the mountains about Helena (Brandeggee). Cooley has collected it at Bozeman.

THE CLODIUS BUTTERFLY.

Parnassius clodius Menetries, Fig. 15.

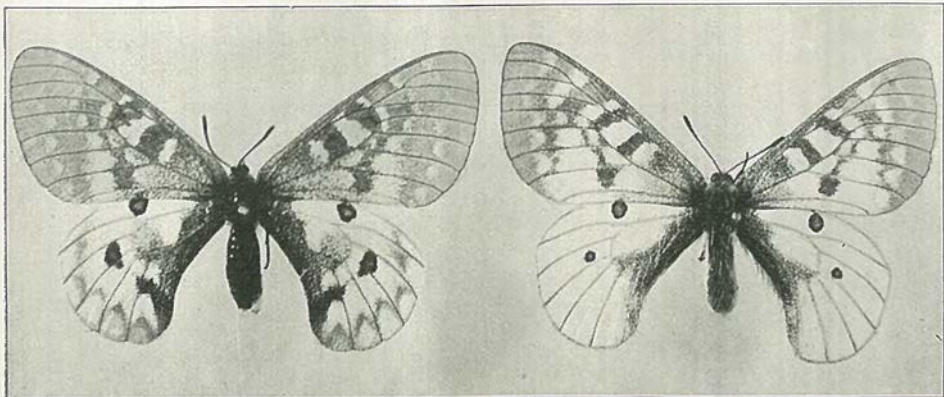


Fig. 15, *Parnassius clodius*.

Prof. R. A. Cooley, of the College of Agriculture and Mechanic Arts at Bozeman, has sent us two specimens, male and female, of this species, taken in Gallatin county, where he reports them rather abundant. The pink and yellow spots are lacking on the primaries in both sexes.

The male has more smoky brown on the outer edge and base of primaries, with more translucent outer margin. The differences are more clearly shown by comparison of Figs. 13 to 15.

Distribution—*Clodius* is found upon the mountains of California. It is reported from the state by Prof. Cooley as stated. Carrington and Logan collected it on the expedition in 1871.

Food—The capterpillar feeds on *Sedum* and *Saxifraga*.

Collecting Butterflies at High Altitudes.

My first high altitude collecting was at 11,500 feet at Seven Lakes, Pike's Peak. It was in August, 1892. Ice formed at night, and all insect life was quiet. During the warm days butterflies were abundant. For the first time I saw *Parnassius* in all its splendor. But to capture it was difficult. Not being accustomed to the high altitude I was unable to make vigorous effort, and after a short chase would drop to the ground gasping for breath. Our camp was in the valley on the bank of one of the "Seven Lakes," in the home of *Parnassius smintheus*. They were out by the thousands. A few miles from camp, toward the main summit, an irrigation or water ditch had the surface of the water covered as far as we could see in either direction with dead or struggling larvae of *smintheus*.

Above timber line and up to the line of perpetual snow there is in summer a profuse growth of Alpine flowers. One who has not seen high altitude vegetation cannot comprehend the beauty, splendor, and profusion of high altitude or alpine flowers. They are a sight never to be forgotten. Above timber line there is in summer a profuse growth. On sheltered or sunny slopes there is a varied vegetation, the flowers making a beautiful sight. One of these visions is the most gorgeous I have ever seen or ever hope to see.

I was caught in a shower of rain, hail, sleet, and snow, and had hastened to a large rock. By clinging with both hands and feet I was somewhat protected. After an hour the storm passed, and the sun came out bright and warm. Sunshine always brings out insects, if they are about. The storm left a deposit of snow an inch or two in depth over the surface of the mountain for miles around. Above the snow, showing their varied colors, were thousands of flowers of different tints, from the genera *Actinella*, *Allium*, *Mertensia*, *Silene*, *Castilleja*, *Polygonum*, *Geum*, *Sedum*, and *Potentilla*. Hovering over these flowers were hundreds of butterflies, displaying their gorgeous colors. It was a rare sight, and a rare combination of snow, alpine flowers and alpine butterflies. The insects were *Parnassius smintheus*, *Colias ochraeus*, *Colias meadii*, *Argynnis eurynome*, *Phyciodes nycteis*, *Argynnis helena*, and *Lycaena rustica*.

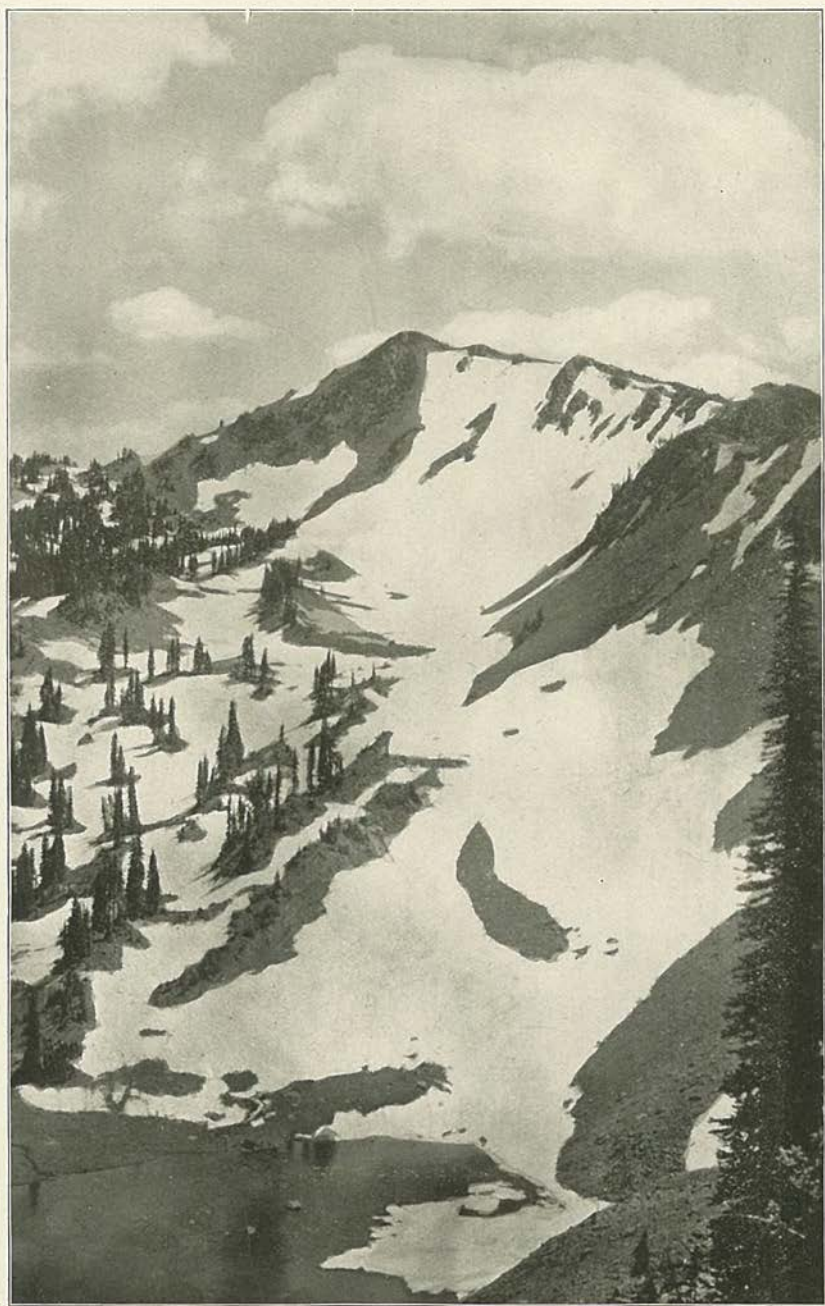
Such a blending and contrast of colors is rarely seen, and forgetting everything I stood for a long time drinking it in. This view is indelibly stamped on my memory. It cannot be forgotten. Soon the mournful squeak of the pika on the rocks nearby called my attention, as it was the pika I was after. In a short time the snow had disappeared, and the six mile walk to camp was cheerfully made.

It has not been my good fortune to climb high mountains. I have done no collecting above 14,000 feet. Among the Rockies of Montana my work has been at altitudes below 10,000 feet. My next attempt at

collecting at altitudes higher than common was in the National Park, at an altitude of 8,500 feet. Again I saw *Parnassius smintheus*, that gorgeous insect of the alpine realm. I gave chase, and after landing the prize in the net sank to the ground exhausted and gasping for breath. In the Mission Mountains of Montana I have had many a happy day among the peaks at 9,500 feet and lower. This short range has some of the most beautiful mountain scenery in the world. Many of the insects taken are recorded in this work. I have collected in the Swan range, and in the main range of the Rockies, at altitudes up to 10,000 feet. In northern Montana timber line is 9,500 feet. In Colorado it is about 11,500 or 12,000 feet. These two elevations in the different localities will probably have about the same flora and fauna, or at least similar conditions. Never have I found insects so abundant as at Seven Lakes on Pike's Peak, and rarely are they abundant. Quite frequently but a single specimen is captured, often but a few. For several years we have annually made the ascent of MacDougal Peak in the Swan Range, whose elevation is approximately 7,600 feet. On these occasions I stay behind to see that all are going down safely. I always loiter on the summit or along the long ridge, collecting a few *Lycaenas*, *Argynnis*, *Pierids*, or *Phyciodes*.

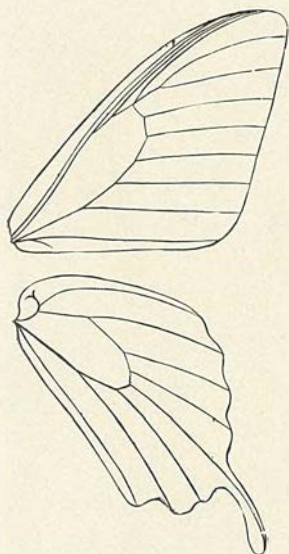
If the butterfly students of Montana will seek healthful exercise, magnificent view of snow-clad mountain summits and peaceful wooded valleys, with a catch of few but rare and very choice insects, let them ascend some high peak in July or August, seek a sunny slope of open woods and abundant vegetation, and pitch their tents for a week. It will add years to the latter end of life.

M. J. E.



View of MacDougal Peak, Swan Range, Montana, in August, showing typical country for Alpine collecting. The summit is about 7,700 feet. Around the top on sunny days one may always catch an abundance of insects. Photo by M. J. E.

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Fig. 16. Venation of *Papilio*.

SUB-FAMILY PAPILIONINAE.

Large species, hind wings tailed. Ground color of the wings black, usually marked with yellow, and often with metallic blue or green, or yellow marked with black. *Papilio*.

Genus *PAPILIO*, Linnaeus.

Butterfly—There is great diversity of form in the wings of this genus. They are large butterflies, often known as swallow tails. The wings are ample; the fore wings triangular; the hind wings concave next to the body, and usually provided with a tail-like appendage before the anal angle; outer margin dentate. See Fig. 16.

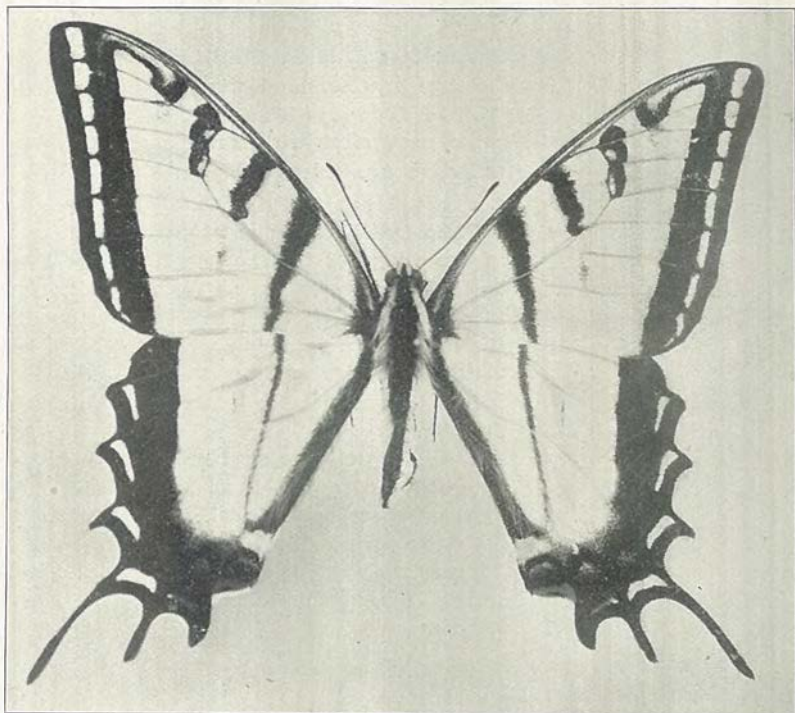
Early Stages—The eggs are somewhat globular, flattened at the base, and smooth. The caterpillars are cylindrical, fleshy, thicker in the anterior portion of the body.

There are about twenty-seven species of this genus found within the limits of boreal America.

KEY TO SPECIES OF *PAPILIO*.

- | | |
|--|--------------------|
| 1. Ground color yellow, with black bands. | 2. |
| Ground color black, with whitish yellow or white bands. | 3. |
| 2. One tail, | <i>rutulus</i> . |
| Two tails, | <i>daunus</i> . |
| 3. One tail; base of fore wings black; an orange lunule with black ocelli on hind wings, | 4. |
| One tail; but little black at base of fore wing, whiter, | <i>eurymedon</i> . |
| One tail; base of fore and hind wings broadly black. | <i>nitra</i> . |
| 4. Sides of thorax yellow, | <i>brucei</i> . |
| Sides of thorax black, | <i>zolicaon</i> . |
| 5. Row of marginal spots on under side of fore wings blending | <i>rutulus</i> |
| Row of marginal spots on under side of fore wings separate | <i>turnus</i> |

THE DAUNUS BUTTERFLY OR SWALLOWTAIL.

Papilio daunus, Boisduval, Fig. 17.Fig. 17, *Papilio daunus*.

Butterfly—Expanse 4.00-5.25 inches. Upper surface of wings clear yellow, costa and outer border of fore wings and posterior border of hind wings black. The black along the costa is suffused with yellow, eight spots in the fore and four lunules in the hind wings. The lunule on the hind wings is orange color. There are four black bands on the fore wings. The first is continued two-thirds across the hind wings and is about one-fourth the distance from the base to the outer margin. The second extends from the costa to a little beyond the median vein; the third extends from the costa across the discal cell; the fourth from the costal to the fifth sub-costal venule. The black terminal border of the hind wings contains blue clouds. It has two tails which are black, edged on the inside with yellow. The under side is similar to the upper. The body is black with yellow stripes on each side.

It is the largest of our butterflies, very conspicuous when on the wing, and eagerly sought by the young entomologist. It is apparently absent from the treeless eastern end of the state.

Food—The early stages have not been thoroughly studied, but it is

allied to the other members of the family. The caterpillar feeds on a great variety of plants.

Distribution—It is found among the eastern valleys of the Rocky Mountains and descends into Mexico. In Arizona it is quite common. In Montana it is on the wing by the last of April. It is very similar to the *turnus* of the eastern and middle states, but is larger, and with two tails to the wings. It is rather common in the western end of the state, but nowhere abundant. Wiley does not report it from the eastern end, except to refer a specimen on the wing to either *daunus* or *rutulus*. Brandegee has taken it at Helena.

THE TURNUS SWALLOW-TAIL.

Papilio turnus, Linnaeus.

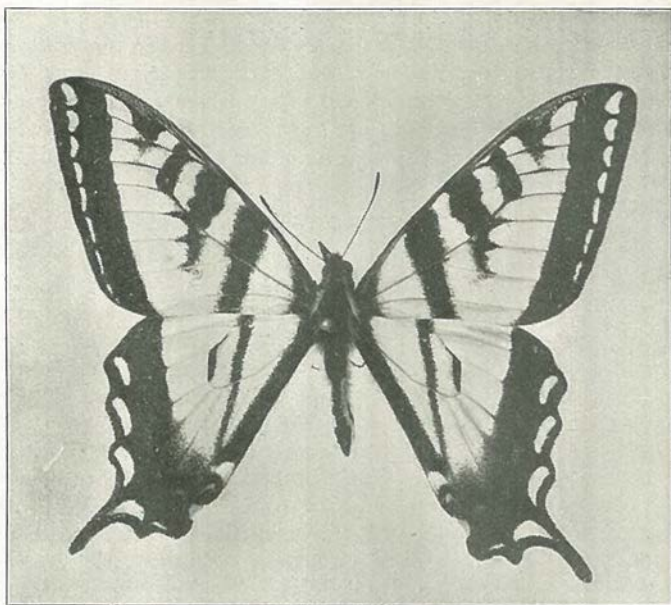
Butterfly—Expanse of male, 3.00 to 4.00 inches, 75 to 100 mm.; female, 3.50 to 5.00 inches, 87 to 125 mm. This species very closely resembles *rutulus*, or, rather, *rutulus* very closely resembles *turnus*. It may be distinguished by the fact that the marginal spots on the under side of the fore wings are separate, while in *rutulus* they join together. The species is dimorphic in the female sex in the southern portion of the territory it occupies. At first the black form was regarded as a distinct species, but it is now known that the black and yellow females are of the same species. By experiments it is shown that eggs from yellow females produce black females, and conversely eggs from black females produce yellow females. The dark or black female does not occur in Canada or in the country northward and westward. Holland has obtained specimens of a small dwarfed yellow form near Sitka.

Early Stages—The egg is green or bluish green, with occasionally some reddish spots. The caterpillar feeds on the wild cherry and other plants.

Distribution—It abounds in the wooded regions in the eastern United States, often in great numbers, extending from New England to the Gulf of Mexico. Westward it is found to the Rocky Mountains, extending northward to Alaska. In the state it has been taken by Carrington and Logan in 1871, locality not given.

Several specimens of *turnus* are among Wiley's specimens in his Miles City collection.

THE RUTULUS BUTTERFLY.

Papilio rutulus, Boisduval, Fig. 18.Fig. 18, *Papilio rutulus*.

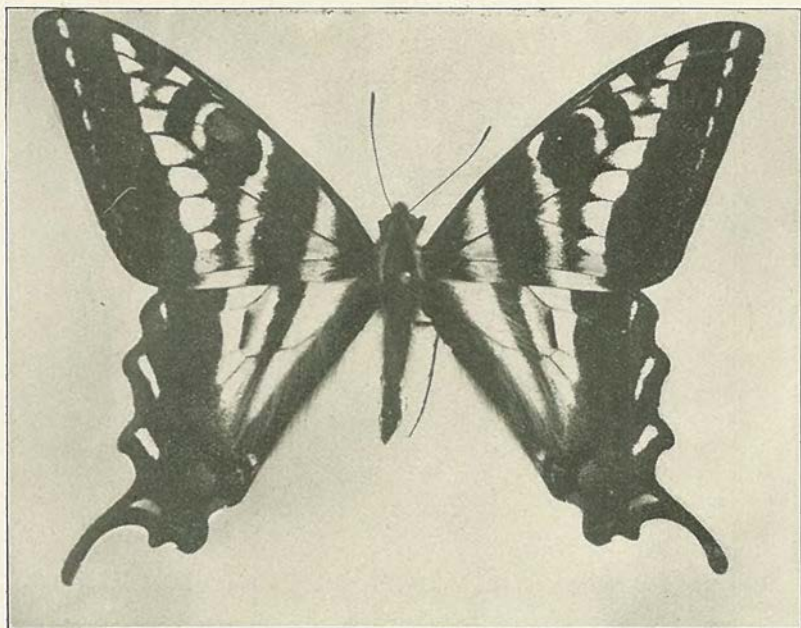
Butterfly—It resembles *P. daunus* in color and markings, but the black bands are broader and it has not the two decided tails. The marginal spots on the under side of the fore wings run together, forming a continuous band. Expanse, male, 3.50-4.00 inches; female, 3.75-4.25 inches, 94 to 106 mm.

This species also closely resembles *P. turnus*, and displaces *turnus* on the Pacific Coast. It is not uncommon. At Missoula it flies as early as May 10. At Swan lake it is abundant in June. It is found as high as 6,100 feet at Missoula.

Food—It feeds on alder and willow, which are very abundant along all Mountain streams.

Distribution—It is a Pacific species. Found throughout the western part of the state. Not reported at Miles City, except as mentioned under *daunus*. Brandegee reports it from Helena. It is fairly common at Bozeman, according to Cooley.

THE EURYMEDON BUTTERFLY.

Papilio eurymedon, Boisduval, Fig. 19.Fig 19, *Papilio eurymedon*.

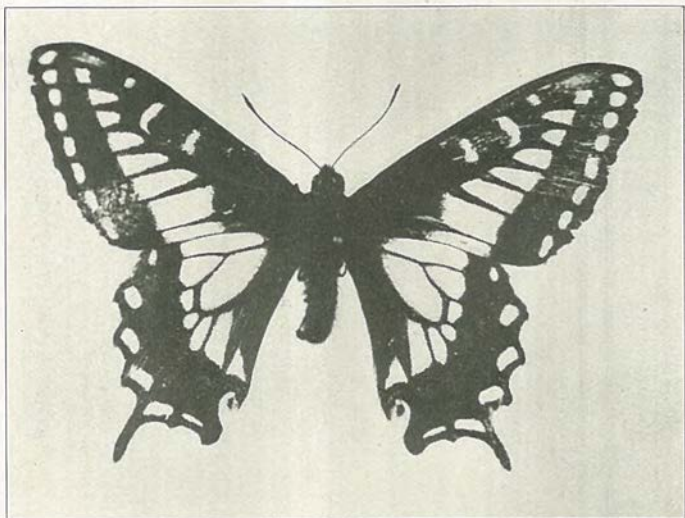
Butterfly—In the style of its marking it resembles *P. daunus*, but the ground color is always pale whitish yellow or white, and the white marginal spots on the under side of the fore wings continuous as in *P. rutulus*. Expanse 3.50—4.00, 87—100 mm.

In the western part of the state it is the most abundant species, flying as early as April 30, and taken through May, June and July.

Food—The caterpillar resembles *P. turnus*, but may be distinguished by its paler color and the much smaller spots composing the longitudinal series on the back and sides, and by the different color of the head. It feeds upon a variety of plants, and is especially partial to *Rhamnus californicus*.

Distribution—The species ranges from Mexico to Alaska, eastward to Colorado. It is abundant in the valleys of the Coast ranges, and is very common in the canyon of the Frazer river, British Columbia, in June. Common, though not abundant, around Missoula, and taken in the Mission mountains and at Swan lake. It has been taken at 6,000 feet at Helena by Brandegee. At Bozeman it is not very abundant (Cooley). Wiley has one specimen from Miles City.

BRUCE'S SWALLOWTAIL.

Papilio brucei, Edwards, Fig. 20.Fig. 20, *Papilio brucei*.

Butterfly—Expanse 3.25-3.60 inches. Under surface yellow, with black borders, the same as in *P. daunus*. The base of the wings is black and it extends in such a way as to make the discal cell appear black with three yellow bars. It has the yellow spots in the black along the costa. It has one tail, and black marking on the veins. The last lunule in the hind wing is orange with a black ocellus. The hind wings have the blue clouds. The body is black. It is thought to be the result of a union between *P. oregonia* and *P. bairdi*.

Food—The caterpillar feeds on Umbelliferae, and is common on parsley and parsnips in gardens.

Distribution—In Colorado and adjacent regions *P. oregonia* meets with the form *bairdi* which ranges northward from Arizona. Hybridization is thought to have occurred, resulting in the fixed form *brucei*, breeding either toward *bairdi* or *oregonia*. *Oregonia* is found in Oregon and Washington, where *bairdi* is absent. We formerly captured a specimen identified by Edwards as *oregonia* and another as *bairdi* near Idaho Falls, which lends support to the hybridization idea. We have sought for *oregonia* in Western Montana, but have found none which could be so called. Most of our specimens have been taken from Missoula. One was taken in the Mission mountains. Cooley has specimens from Bozeman, thought to be *zolicaon*. Possibly Wiley's *zolicaon* may be *brucei*.

THE ZOLICAON BUTTERFLY.
Papilio Zolicaon, Boisduval, Fig. 21.

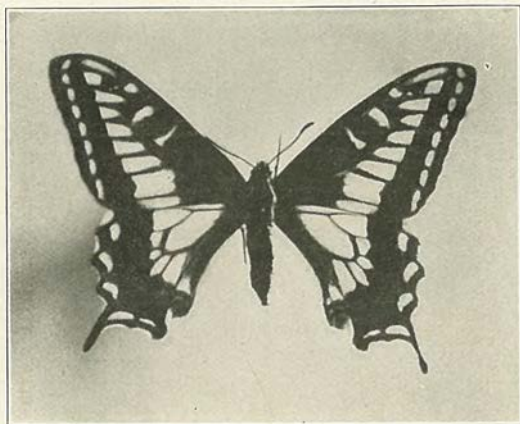


Fig. 21, *Papilio zolicaon*.

Butterfly—Expanse 3.25-3.75 inches. Upper side of primaries black, marked and spotted with deep yellow; of secondaries yellow from base nearly two-thirds the distance to margin, beyond black; primaries have a sub-marginal row of eight spots, and a discal series of eight forming a band across the entire wing; the first discal spot excavated on the upper side, sometimes divided into two. Secondaries with a broad black border which incloses a sub-marginal series of six yellow spots, the first often wanting; an orange or deep fulvous spot, inclosing a round or oval or black spot, and edged on the upper side by a blue crescent, the ring occasionally wanting; the rest of the wing yellow, divided into eight spots, the cell being one, by the black nervures. Under side nearly as above, the colors paler.

Food—The caterpillar feeds on the Umbelliferae, fennel, carrot and celery.

Distribution—Southward from Vancouver's Island to Arizona, eastward to Colorado. Reported by Wiley to be rare at Miles City. Collected by Dr. Hayden in Montana in 1871.

THE NITRA SWALLOWTAIL.

Papilio nitra, Edwards.

Butterfly—This butterfly is very nearly related to *zolicaon*, but the black is widely spread over the base of the wings so as to make the yellow appear like a broad band, and the two yellow bars in the fore wings are very indistinct.

Holland reports this insect rare in collections, and says it has sprung from the same original stock as *zolicaon* and *aliaska*, the latter being an offshoot from the Asiatic butterfly. We have not seen the species.

Food—Early stages and food unknown.

Distribution—It occurs in Montana and the portions of British America adjacent on the north.

FAMILY PIERIDAE.

Small or medium sized; hind wings not tailed; white or yellow in color; with dark marginal markings. Pierinae.

SUB-FAMILY PIERINAE (The Sulphurs and Whites.)

Medium sized or small butterfly, white or yellow in color, with dark marginal markings. In many genera the sub-costal vein of the fore wing has five, or even six nervules, and the upper radial is lacking in this wing. The eggs are spindle shaped, marked with vertical ridges and cross lines. The caterpillars are cylindrical, generally green in color. The chrysalids are generally more or less jointed at the head.

Key to Genera.

1. Antennae abruptly terminating in an ovoid club. 2.
 Abtenuae terminating in an obconic club. 4.
2. Abdomen shorter than the hind wings; color white or very pale yellow. 3.
3. Underside of hind wings without marks, or marked along the veins; size, medium. Pontia, P. 27
 Underside of hind wings marked with a greenish net-work; small size. Synchlœ, P. 32
4. Hind wings with an orange discal spot, both wings with black border Eurymus, P. 37
 Medium sized; costa black as far as the end of the cell; transparent white wings; apex black with white spots. Neophasia, P. 26

Genus NEOPHASIA Behr.

Butterfly—Medium size, white in color. The upper radial is lacking, and the sub-costal is provided with five branches, the first emitted well before the end of the cell.

Early Stages—The egg is flask shaped. The caterpillar in its mature form is about an inch long. The body is cylindrical, terminating in two short anal tails. The color is dark green, with a broad white band on each side. But one species is known.

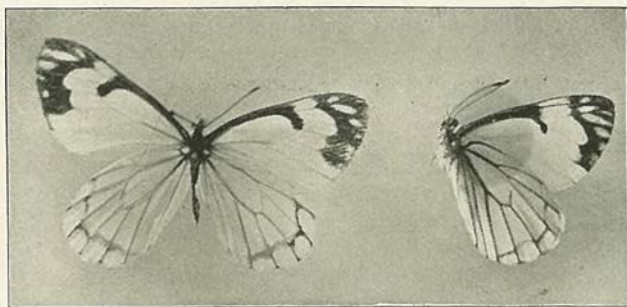
Key to Species.

Almost a transparent white, a black border to fore wings, and a black bar across the discal cell, meeting the border, menapia.

THE PINE WHITE.

Neophasia menapia Felder. Figs. 22, 23.

Butterfly—Medium sized; hind wings white with dark veins on the under side; black and white apex.

Fig. 23. *Neophasia menapia*.

Early Stages—Described by Edwards. "The caterpillar infests the pine trees and firs of the northern Pacific States. The larva lets itself down by a silken thread, often a hundred feet in length, and pupates on the ferns and shrubbery at the foot of the trees. It sometimes works great damage to the pine woods."

Fig. 22. Venation of *Neophasia menapia*

Distribution—It does not seem abundant in the west end, but has often been seen in the Mission mountains and about the laboratory at Big Fork high up in the coniferous trees out of reach of the collector. At Swan lake it was found rather abundant late in August, 1903. In August, 1904, about 40 were taken in a half hour, about half way up the lake. The collecting region at Swan lake for this species is along the lower half of the lake shore. Very few have been seen around the upper end.

Genus *PONTIA* FABRICIUS.

(The Whites). Fig. 23.

Butterfly—White, more or less marked with black, occasionally the white is tinged with yellow. The outer margin of the primaries is straight, the outer margin of the secondaries is more or less evenly rounded. The egg is spindle shaped. The caterpillar is elongate, the head hemispherical. The chrysalis is attached by the anal extremity, and held in place by a silk girdle.

Key to Species.

1. Fore wings with a black bar at the end of the cell, and more or less of a black border, 2.
Fore wings with no black bar at the end of the cell. 3.
2. Markings on under side concentrated in brownish blotches, protodice.
Markings on under side of hind wings green blotches on the disk, beckeri.
Markings on under side as rays on either side of the veins, occidentalis.
Veins of fore wings black, spots smaller. sisymbri.

3. Under side of hind wings plain yellow. No marks along the veins, rapae. 4.
 Under side of hind wings marked along the veins, 4.
 4. Black border to both wings, monuste. 5.
 No black border to wings, 5.
 5. Under side of hind wings pale yellow, with brownish along the veins, napt. 5.

THE PROTODICE BUTTERFLY, OR SOUTHERN WHITE.

Pontia protodice Bois. and LeConte. Fig. 24.

Summer form, *protodice*, Bd. and Lec. Expanse of wings from 1.6 to 1.8 inches, 40 to 45 mm.

Male. Upper surface white, fore wings with a broad black dash or bar across the end of the discal cell, and a sub-marginal row of three more or less distinct spots, the last almost or quite touching the hind margin. Traces of rays run from this row to the outer edge. Hind wings without spots. Bars and spots are repeated on the under side. Veins of hind wings are broadly marked with greenish yellow sprinkled with brown seals, and the tips of the fore wings tinged with greenish yellow.

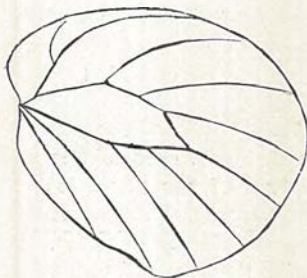
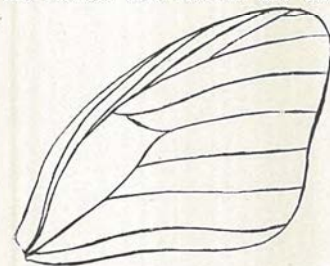


Fig. 24. Venation of *Pontia*.
(*P. protodice*)

with some white hairs and scales.

Distribution—This insect is usually known as the Southern Cabbage butterfly, though it is to be found everywhere east of the Rocky mountains. It is injurious in the larval state in the southern states. In the northern states *P. rapae* is more common, in many places driving out *protodice*. There are several broods during a season.

Wiley has taken it at Miles City; Brandegee has collected it at Helena; Cooley has it from Bozeman; Douglass collected it in the Ruby Mountains and Madison Valley; Elrod has taken it at Missoula, Flathead Lake, and in the Mission Mountains, Coubeaux has it from Big Sandy. Collected by Coues along the 49th parallel in 1874.

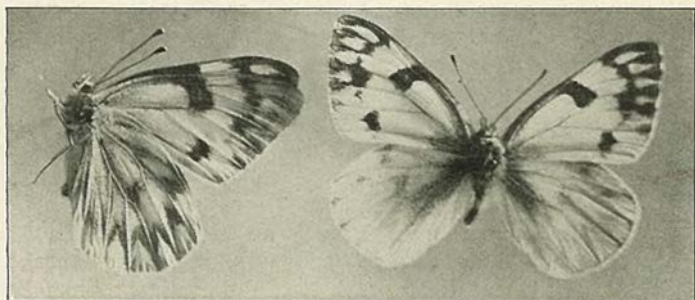


Fig. 25, *Pontia protodice*.

Its food consists of cruciferous plants. It is destructive to cabbage.

THE WESTERN WHITE, *Pontia occidentalis* Reakirt.

Butterfly—Size about 1.75 inches, distinguished from *P. protodice* by its smaller size and different markings. On the under side of the wings the dark markings are not concentrated in blotches, but are in broad longitudinal rays on either side of the veins from the base to the outer margin. Spots on the upper side much smaller than in *protodice*, and fewer. The females are sometimes lemon yellow above.

Early Stages—Similar to those of *protodice*.

Distribution—It is found from the Rocky Mountains to the Pacific. Wiley has it in his collection from Miles City; Cooley has taken it at Bozeman; Brandegee at Helena; Douglass at Madison Lakes; Elrod at Missoula, and on MacDougal Peak. It is likely to be found any place in the state. Allen has taken it at Dillon. Coues collected it in 1874 along the 49th parallel.

THE CABBAGE BUTTERFLY. *Pontia rapae*, Linnaeus. Fig. 26.

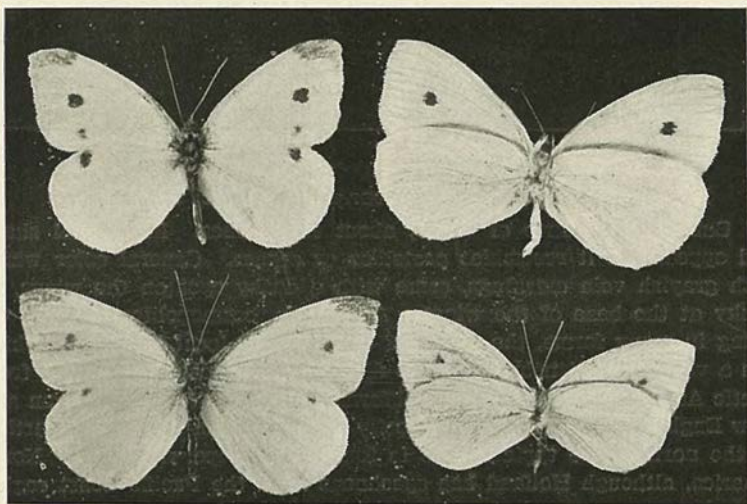


Fig. 26. *Pontia rapae*; upper figures show both surfaces of female, lower figures same for male.

Butterfly—Known as cabbage butterfly; yellowish white, with apex of fore wings black. Two black spots on fore wings and one on the hind wings. Underneath, the apex of the fore wings and the entire surface of the hind wings are pale lemon yellow. In the female two spots on outer part of fore wings, in male only one.

The larva feeds principally on cabbage. Its color is green like the cabbage leaf, with a narrow greenish lemon yellow dorsal band. The body is clothed with very fine short hairs.

Distribution—This common species is an importation from Europe. It reached Quebec in 1860; how, no one knows, perhaps in cabbage. By 1881 it had spread over the eastern half of the continent, from Hudson Bay to Southern Texas. In 1886 it had reached Denver, and in 1884 had reached the head waters of the Missouri. It now possesses the cabbage fields from the Atlantic to the Pacific, "to the incalculable damage of all who provide the raw material for sauerkraut." The injury done by the caterpillar is estimated to amount to hundreds of thousands of dollars.

It is probably to be found all over the state, and has been taken at almost every place where collections have been made, at Missoula, Miles City, Bozeman, Helena, University of Montana Biological Station at Flat-head Lake, Mission Mountains. It does not seem as common as *P. protodice*. Allen collected it at Dillon.

THE MUSTARD WHITE.

Pontia napi Linnaeus. Fig. 27.



Fig. 27. *Pontia napi*, No. 1, var. *pallida* No. 2, var. *acadica*.

Butterfly—Expanse of wings, about 1.75 inches. In general shape and appearance it resembles *protodice* or *rapae*. General color white, with grayish vein markings, some with a dusky spot on the wings, or dusky at the base of the wings. A Protean, cosmopolitan species, existing in many forms, the result of climatic and local influences, which has a very wide distribution. The different forms are to be found from Arctic America as far south as California on the west, and Michigan and New England on the east. It is mostly represented in the regions farther to the north. The typical form is found in Europe, rarely in North America, although Holland has specimens from the Pacific Coast region

which he says are absolutely indistinguishable from European specimens in color and markings.

Var. *pallida*, Scudder. The wings are white above and below, with small black spot on the fore wing of the female above, and hardly any trace of dark shading along the veins on the under side; a trace of dark on the hinder edge and base of fore wings. One specimen taken at Flat-head Lake, August, 1903. One taken in the big meadows at the upper end of Swan Lake, August 8, 1904.

Var. *acadica*, Edwards. The veins of the wings have narrow border above and below of blackish, more pronounced in the female, base of wings and sometimes the tips dusky. The under side in both sexes and the upper side in the female are distinctly yellowish. Specimens from Montana have been examined as follows: One from Helena (Brandegge) June 26, 1902; four from Missoula, one April 28, 1900, one June 1, 1900, one June 12 1899 one October 1897; one from Bozeman (Cooley); three from Miles City (Wiley).

THE CALIFORNIA WHITE.

Pontia sisymbri, Boiduval Fig. 28.

Butterfly—Expanse of male, 1.2 to 1.6 inches, 33 to 40 mm.; female, 1.6 to 2.00, 40 to 50 mm. Upper side of male white with a faint yellow tint; bases of wings dusted with black; primaries have the costal margin gray for three-fifths the length from base; the ends of the nervules from apex to second branch of median covered by black bars, which diminish gradually in length down the margin; midway between margin and cell is a transverse black band, interrupted opposite cell, and running from costa to upper median interspace; in the arc a black bar, indented on outer side; secondaries immaculate; fringes of both wings white; black at the ends of the veins.



Fig 28. *Pontia Sisymbri*.

Under side same color; the markings repeated, but paler or gray, the bars along margin of primaries greenish-gray.

Body gray above, thorax white below, abdomen yellowish; legs white, palpi white with black hairs in front; antennae black above, whitish beneath; club black, the tip orange.

Female similar to male.

Early Stages—The eggs are long, narrow, conical, the base and top flattened, depressed; ribbed longitudinally, and crossed by numerous striae; color when first laid yellow, shortly before the end of the stage red. Mature larva about .9 inch, 25 mm., color light yellow crossed with stripes of black. The caterpillar feeds upon the cruciferae.

Distribution—Found in Colorado and the Pacific states. Collected by Elrod at Missoula.