

# JOURNAL OF THE LEPIDOPTERISTS' SOCIETY

Volume 18

1964

Number 2

## THE LIFE HISTORY OF *PAPILIO INDRA MINORI*

by JOHN F. EMMEL and THOMAS C. EMMEL

Stanford University, Stanford, Calif., U.S.A.

One of the rarest of all North American butterflies is the narrow-banded subspecies of *Papilio indra* Reakirt occurring in the wild mesa country of western Colorado. Described by Frank C. Cross in 1937, this subspecies was named *Papilio indra minori* in honor of the discoverer, Mr. Will C. Minor of Fruita, Colorado. Since that time, apparently less than one hundred adult specimens have found their way into collections. The habits of the adult butterflies have been described in engaging and thorough detail by Donald Eff (1962), the other lepidopterist besides Will Minor who has had the most experience with this rarity. Until 1963, however, the food plant and life history of *P. indra minori* were undetermined. The present paper reports the food plant and describes the egg, larva, and pupa of the insect from material collected in the type locality.

### GENERAL REMARKS

The home of *P. i. minori* is along the edge of Black Ridge, near Colorado National Monument in Mesa County, Colorado. While at Black Ridge on May 12 and 13, 1963, Don Eff collected two females; one of these was caught *in copula*. Since the freshly mated female would produce more eggs than an older and possibly unmated female, and kindly answering a standing request, Mr. Eff sent the mated female to us, and on May 16 it was confined in a net bag placed over a growing plant of *Tauschia arguta* (Umbelliferae), a known food plant of *P. indra pergamus* Hy. Edw. (Emmel & Emmel, 1963). On alternate days, the female was transferred to a net bag placed over *Foeniculum vulgare*, another umbellifer used as a laboratory food plant for *Papilio bairdii* Edwards, *P. oregonius* Edwards, and *P. rudkini* Comstock (Emmel & Emmel, 1963). Before dying after six days, the female laid a total of 30 eggs; all were oviposited on the *Tauschia* plant. Unfortunately, the eggs proved to be infertile.

As the adults' flight period is restricted to late April and May, it seemed probable to us that advanced larval stages might be found on some umbellifer around Black Ridge in the early part of June, since the eggs of other *P. indra* subspecies — always laid on umbellifers — develop immediately and the insects go through a winter diapause in the pupal stage. Accordingly, after correspondence with Will Minor and Donald Eff, we met Mr. Minor at his home in Fruita on the afternoon of June 16, 1963. He generously consented to take us to Black Ridge in his Jeep, and we arrived at Coal Mine Point, the type locality, at about 4:00 p.m., where we began an immediate search for the food plant.

#### DESCRIPTION OF FOOD PLANT AND HABITAT

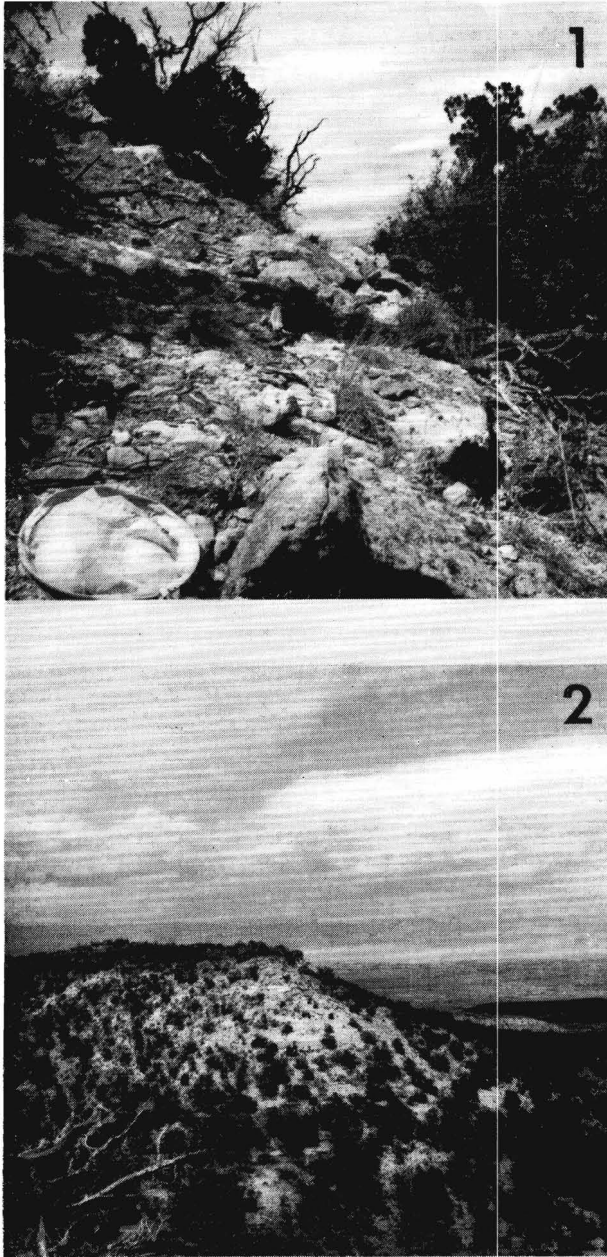
Eff (1962 and *in litt.*), by process of elimination of plants in the local flora, had suspected the food plant to be *Lomatium grayi* (Coult. & Rose), an umbelliferous species generally distributed over western Colorado from four to eight thousand foot elevations. However, the umbellifer Eff found at Black Ridge may have been misidentified by the botanist who examined his specimens, since another species, *Lomatium eastwoodae* (C. & R.) Macbr., turned out to be the only *Lomatium* species we could find at Coal Mine Point. This plant, *Lomatium eastwoodae*, was discovered to be the food plant of *P. i. minori*.

The *Lomatium* species at Black Ridge keyed out as *eastwoodae* in Mathias (1938) and in Harrington (1954). The identification was further verified by comparison with *L. eastwoodae* specimens (sheet no. 330463) in the Dudley Herbarium at Stanford University, which were labeled as having been collected at "e. edge of Black Ridge, Colo. Nat. Mon., Mesa Co." According to Mathias (1938), *L. eastwoodae* was known only from the type locality ("near Grand Junction, Colo."). Because of the great rarity of this plant and the lack of readily accessible published descriptions and herbarium specimens, a description follows and an illustration of a single plant with fruiting umbels is provided herein in Figure 12.

**DESCRIPTION OF FOOD PLANT:** The plants are about 10 to 15 cm. tall from "a subwoody caudex covered with old leaf sheaths; leaves narrowly oblong, scaberulent, the blades 2.5-7 cm. long, 1-2-pinnate, with 5-7 remote pairs of segments, the leaflets oblong-lanceolate, 2-4 mm. long, 1-1.5 mm. broad, crowded, apiculate, the petioles 1.5-4.5 cm. long, shortly sheathing below; . . . umbels 4-6-rayed, the fruiting rays unequal, 1-3 cm. long, ascending; . . . fruit oblong, 8-10 mm. long, about 6 mm.

---

Fig. 1. Slope immediately below Coal Mine Point, Black Ridge, Mesa County, Colorado (type locality of *Papilio indra minori*). *Lomatium eastwoodae* plants grow mainly at the base of ledges or boulders, with occasional plants being found beneath junipers and pinyon pines. Several *Lomatium* plants are located above



the net and in front of the boulder at the right side of the photograph, but their size makes them difficult to see from more than a few feet away.

Fig. 2. View of the eastern end of Black Ridge. *Lomatium eastwoodae* plants were generally distributed across the open rocky slopes.

broad . . ." (Mathias, 1938). The umbellets are 2-15-flowered and the flower color is believed to be yellow. (Only dried flowering specimens were examined by Mathias, and only fruiting plants were observed by the present authors.) From our observations of the various fruiting stages that the plants were in at mid June, it would seem that flowering probably occurs from April to early May.

**HABITAT:** The small, grayish-green plants were located among the rocks on the north side of Coal Mine Point, where the mesa walls begin to drop precipitously toward the canyons bordering the Colorado River in Fruita Valley (Figure 1). After about 20 minutes of searching on June 16, one of us (T. C. E.) found the first larva, a fully mature one resting in a rocky crevice between boulders near a *Lomatium* plant. Two more larvae were found that afternoon, both fourth instar and both on *Lomatium* leaves. The next day was spent at the eastern end of Black Ridge, on the border of Colorado National Monument, where a number of *Lomatium eastwoodae* plants were located on a south-easterly-facing slope (Figure 2). An intensive search yielded two larvae, one in third instar and the other in fourth instar.

Along Black Ridge, as will be noted in the figures, the habitat is arid, with open Pinyon Pine and Utah Juniper forest extending up the rocky slopes of the ridge from the canyons below and also covering the mesa tops. Interspersed among the low trees are such shrubs as sagebrush (*Artemisia*) and Mountain Mahogany (*Cercocarpus*), with *Yucca*, *Senecio*, and other wildflowers scattered along the slopes and washes. The elevation along the top of Black Ridge (from the eastern end to Coal Mine Point) is about 7,000 feet above sea level.

Further trips to the Colorado National Monument area on July 1-4, July 12-14, and July 20-21 did not produce more larvae of *P. i. minori*; indeed, even on the first of July most of the *Lomatium eastwoodae* plants were dried up and shriveled. Thus it seems probable that *P. indra minori* is single-brooded like *P. indra indra* in the Sierra Nevada (Emmel & Emmel, 1962) and *P. indra fordii* in the Mojave Desert mountain ranges (J. F. Emmel, unpublished).

The five *P. i. minori* larvae collected in June were reared at the Rocky Mountain Biological Laboratory, Gothic, Colorado, on intact *Lomatium eastwoodae* plants. Although all larvae reached maturity, only two pupated successfully. In the three that died while pupating, no parasites or evidence of disease were noted.

#### LARVAL HABITS AND POSSIBLE MIMICRY BY A MOTH LARVA

Feeding habits in the laboratory differed among the instars. The third instar larva remained on the leaf of the *Lomatium* plant, near the tip. The fourth instar larvae rested always on the petioles near the base of

the plant, moving to the outer edges of the leaves to feed. When disturbed, the third and fourth instar larvae immediately dropped off the plant. The fifth instar larvae, when not feeding, crawled up the sides of the netting bag suspended over the potted food plant, and remained motionless there. The larvae fed both during the daylight hours and at night.

On June 16, a geometrid larva was also taken on *Lomatium eastwoodae* at Coal Mine Point. Its pattern of coloration was superficially similar to that of a mature *P. i. minori* larva, and at first sight it was mistaken for this. Its length was about 40 mm. at maturity; its width was only about 6 mm. This coincidence of parallel color pattern may involve a case of Müllerian mimicry, where both insects are using a common conspicuous pattern of (warning?) coloration in the larval stage.

#### DESCRIPTION OF EARLY STAGES

##### EGG

The egg is identical in shape and coloration to the egg of *P. indrafordi*, while being slightly larger in size (about 1.1 mm.). The surface texture is smooth, and the color is cream when first laid. The drawing in Figure 3 is of one of the infertile eggs mentioned in the text above.

The one female observed in captivity laid her eggs singly, near the tips of the *Tauschia arguta* leaves.

##### THIRD INSTAR LARVA

A dorsal view of the third instar larva is shown in Figure 4. The length of this larva at maturity was about 10 mm.; its coloration and pattern did not differ noticeably from those of the fourth instar larvae (see following description).

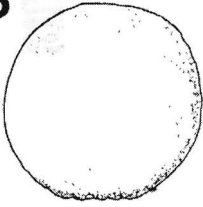
##### FOURTH INSTAR LARVA

Length: 17 mm. at maturity.

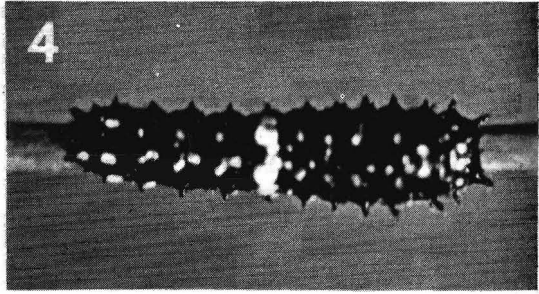
Head: Jet black, with an inverted crescent-shaped mark of light orange at the center and four white dots arranged across the upper margins (one pair on each side).

Body: Ground color black, with a blue sheen in strong side lighting (lateral view in Fig. 5). There are four anterior-posterior rows of black, pointed tubercles. The tubercles in the two dorsally-situated rows have orange spots located just medially to their bases. The tubercles in the two lateral rows have orange or white spots located just dorsally to their bases, and are about one-half the length of the dorsal tubercles. The white "saddle" mark on the seventh abdominal segment is irregularly shaped but is continuous in contrast to the "row of large oval white spots, transversely circling the body at about the seventh segment" on the fourth-instar *P. indrafordi* larva (Comstock & Martin, 1955: p. 148).

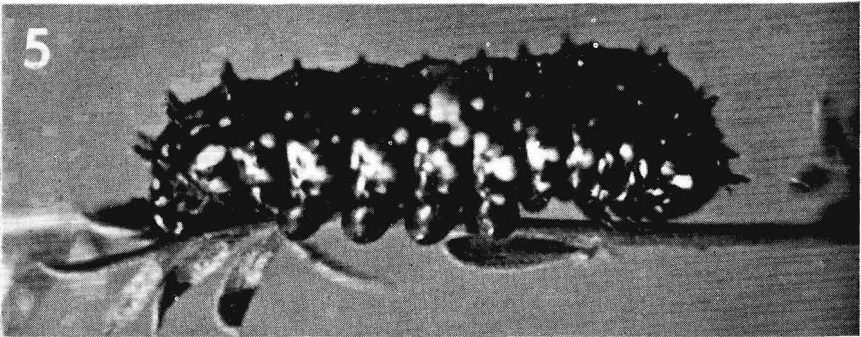
3



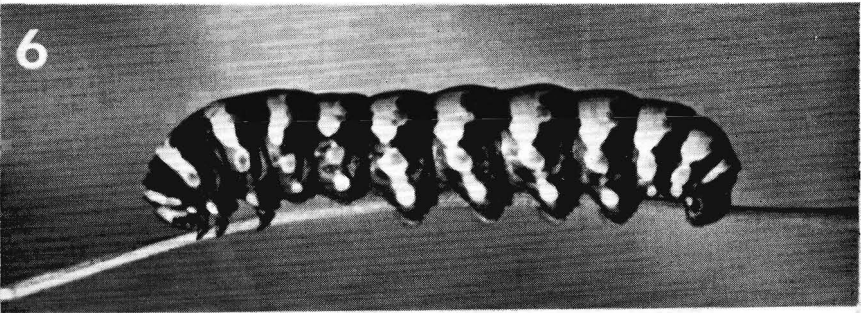
4



5



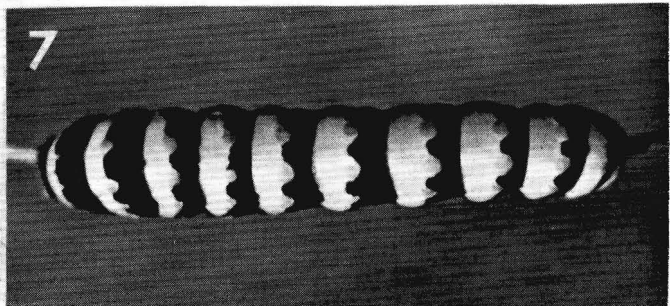
6



8



7



This "saddle" mark and the following marks varied slightly among the four *P. i. minori* larvae of this instar that we were able to observe. There is a lateral row of eleven light-orange spots immediately below the lateral row of tubercles, extending from the first segment to the caudal end. An irregular pattern of small white marks occurs along the lateral row of tubercles, and transversely around the last three body segments. A white spot occurs on the lateral side of the base of each thoracic leg; the thoracic legs and prolegs are black.

#### FIFTH INSTAR LARVA

Length: 37 to 40 mm. at maturity. Greatest width: 8.0 mm.

Head: 4 mm. in width. Jet black in color. An inverted "V" of red-orange occurs on the adfrontal margins (see Figure 8 for pattern).

Body: See Figures 6 and 7. Ground color, deep black. The first segment is edged anteriorly with a narrow band of pink (ending on each side at an orange spot), and has a broad band of black posteriorly. Each of the remaining segments has a wide, anterior, pink band arching over the dorsal surface. These bands end above (on segments 4-6) or surrounding (on segments 1-3, 7-11) the large lateral spot of orange found on each segment. The posterior margins of the pink bands curve caudally a short distance at four locations to surround an orange dot. These orange dots (dorsal to the large lateral dot) occur in four longitudinal rows: one on each side of the dorsal area, and one placed suprastigmatically on each side. The true legs and prolegs are black, with a large white dot occurring on their sides. The segments without legs likewise bear this single subventral white spot. The crochets are translucent gray, and the spiracles are black.

DISCUSSION: A later paper will present a comparative analysis of the biology of all the subspecies of *Papilio indra*. However, as the early stages of *P. i. minori* seem to be closest to those of *P. i. fordi* in the *Papilio indra* group, we may compare these briefly. The general light and dark pattern of the larval body is nearly identical to that of the mature larva of *P. indra fordi*, as described by Comstock and Martin (1955). The details of the coloration differ, however. The deep black areas on the *P. i. minori* larva never have the occasional blue sheen of *P. i. fordi* larvae. The light bands arching dorsally over the body segments are a

---

Fig. 3. Egg of *Papilio indra minori*. Actual diameter about 1.1 mm. Lateral aspect.

Fig. 4. Third instar larva of *P. indra minori*, dorsal aspect.

Fig. 5. Fourth instar larva of *P. indra minori*, lateral aspect. Note detail of *Lomatium eastwoodae* leaf.

Fig. 6. Fifth (last) instar larva of *P. indra minori*, lateral aspect.

Fig. 7. Same fifth instar larva of *P. indra minori* as in Fig. 6, but dorsal aspect.

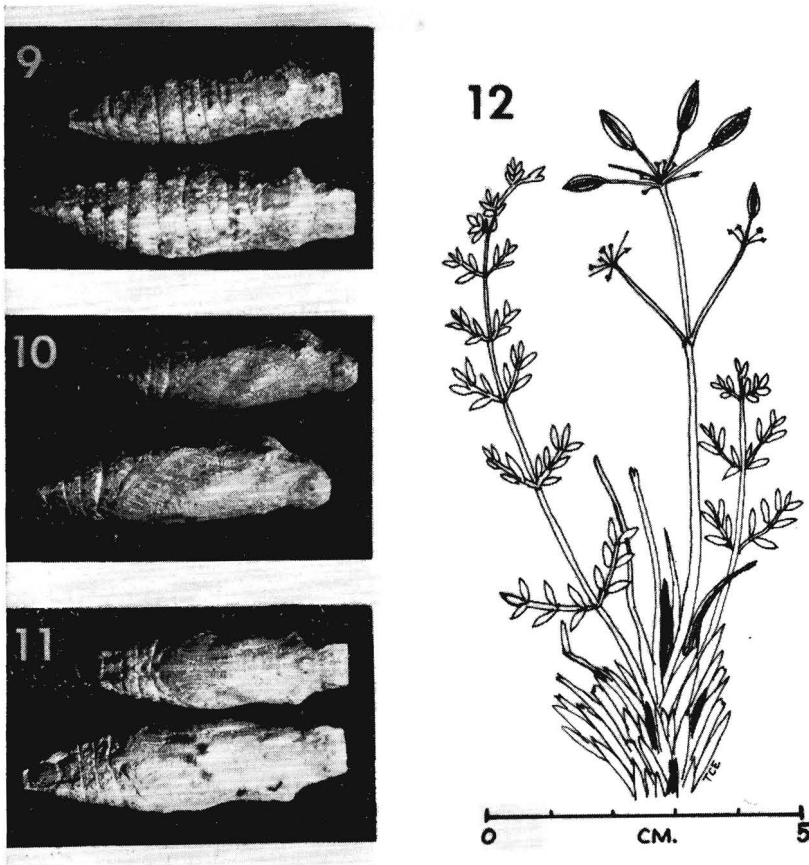
Fig. 8. Detail of the head of the fifth instar larva of *P. indra minori*. Dark areas black, light areas a red-orange, in this frontal view.

delicate PINK, rather than white or bluish-white as in *fordi*. The large dots on these bands are the same size as those found on *fordi*, but the color is a deep orange rather than lemon yellow. All other spots on the body are light pink in color or, occasionally, white, rather than yellow as on *P. i. fordii* larvae. As with *P. i. fordii* and *P. i. pergamus* larvae, the width of the black bands on the body segments varies between individual larvae.

#### PUPA

Male: Length, 20.9 mm. Greatest width at wing cases, 6.0 mm.

Female: Length, 24.5 mm. Greatest width at wing cases, 7.0 mm.  
(Figures 9, 10, 11).



Figs. 9, 10, 11. Pupa of *P. indra minori*. Dorsal, lateral, and ventral aspects, respectively. The smaller male pupa is shown above the female pupa in each figure.

Fig. 12. The food plant of *Papilio indra minori*: *Lomatium eastwoodae* (Coul. & Rose) Macbr. The leaves, umbel, and fruit are shown growing from the subwoody caudex covered with old leaf sheaths.



The pupa of *P. indra minori* is nearly identical to the pupa of *P. indra fordi* (illustrated in Comstock & Martin, 1955). The ground color is a grayish tan, with short light and dark streaks giving all surfaces except the wing cases a lightly mottled appearance. The wing cases are predominantly olive-tan. The surface is rough with a profusion of tiny raised points and small wart-like nodules. There are two longitudinal rows of papillae extending posteriorly from the thoracic region: one row on each side of the dorsal area, and a second row placed suprastigmatally. These papillae are not lightly colored and conspicuous, as opposed to those on the pupa of *P. indra fordi*.

---

#### ACKNOWLEDGEMENTS

The present paper is part of a continuing study of species of the *Papilio machaon* complex in western North America. The aid of the Gordon F. Ferris Memorial Scholarship (to J. F. E.) from Stanford University is gratefully acknowledged.

Mr. Will C. Minor of Fruita, Colorado, was exceedingly helpful during our visit to the Black Ridge area. Superintendent F. G. Bussey and Naturalist Clarence J. McCoy of the National Park Service were most helpful in granting us a collecting permit to collect within Colorado National Monument and in answering our many questions about the area and its butterfly fauna. Mr. Donald Eff of Boulder, Colorado, very kindly supplied us with a living female of *P. indra minori* and detailed information on the type locality. Dr. Paul R. Ehrlich, Division of Systematic Biology, Stanford University, reviewed the manuscript and offered helpful assistance at the Rocky Mountain Biological Laboratory.

---

#### Literature Cited

- Comstock, John A., & Lloyd M. Martin, 1955. A new *Papilio* from California. *Bull. so. Calif. acad. soc.* 54: 142-148.
- Eff, Donald, 1962. A little about the little-known *Papilio indra minori*. *Journ. lepid. soc.* 16: 137-142.
- Emmel, Thomas C., & John F. Emmel, 1962. Ecological studies of Rhopalocera in a High Sierran community - Donner Pass, California. I. Butterfly associations and distributional factors. *Journ. lepid. soc.* 16: 23-44.
- ....., 1963 Larval food-plant records for six western Papilios. *Journ. res. lepid.* 1: 191-193.
- Harrington, H. D., 1954. *Manual of the plants of Colorado*. 666 pp. Sage Books, Denver.
- Mathias, Mildred E., 1938. A revision of the genus *Lomatium*. *Ann. Missouri bot. garden* 25: 225-297.

---

## ATTRACTION OF BUTTERFLIES TO LIGHT

by D. G. SEVASTOPULO

P. O. Box 5026, Mombasa, KENYA

With reference to Mr. Donohue's note (*Journ. lepid. soc.* 16: 131-132; 1962), the paucity of Indian records of butterflies attracted to light can, I think, be explained partly by the fact that the older generation of entomologists saw nothing remarkable in the occasional visit of a