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IMMATURE STAGES OF *COLIAS JOHANSENI* FROM ARCTIC CANADA (LEPIDOPTERA: PIERIDAE)

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ABSTRACT: The immature stages of *Colias johanseni* are described and figured. The probable larval host plant is *Hedysarum mackenziei*, a common arctic Legume.

KEYWORDS: *Colias hecla*, Northwest Territories, Nunavut, Coppermine, drumlin, fusiform.

The purpose of this paper is to describe the immature stages of *Colias johanseni* Troubridge and Philip, 1990. *C. johanseni* was first collected by Frits Johansen at Bernard Harbor, Northwest Territories, Canada in 1916 during the Canadian Arctic Expedition. Bernard Harbor is 107 km north of Coppermine along the coast of the Arctic Ocean. Coppermine, a native village, now goes by the name Kugluktuk and this area is now in the Nunavut Territory. One male *C. johanseni* was taken by Johansen. *Colias johanseni* was next collected by Troubridge and Philip at Bernard Harbor in 1988. They described this taxon from these specimens. *Colias johanseni* was next collected by this author during the summer of 1998 at Bernard Harbor and Cape Kendall. One male was taken at Cape Kendall which represents the only known location other than Bernard Harbor. Cape Kendall is 87 km south of Bernard Harbor and 20 km north of Kugluktuk.

MATERIALS AND METHODS

Oviposition: One female *Colias johanseni* was collected, at Bernard Harbor, *in copulo* with a male *C. johanseni*. The pair was safely contained until after copulation was completed. The female was put into a plastic container with a screen cover. Sprigs of an *Astragalus* species for an oviposition substrate were inserted into water inside the container. The female would not oviposit on the *Astragalus* so the *Astragalus* was replaced with *Hedysarum mackenziei* Richards on which she readily oviposited. Troubridge and Philip reported *H. mackenziei* as the probable larval host plant by association with the females. The container was placed in indirect sunlight for the female to oviposit. The female oviposited eggs singly on the upper side of a leaf. Ova were removed in two or three day intervals and placed in a container to await hatching.

Rearing: The larvae were reared on cut stems of *H. mackenziei* that were placed in water to retain freshness in a plastic container with a fine mesh cover. Larvae were disturbed only when it was apparent that they had quit eating and were preparing to molt or pupate.

Observations: Morphological observations and measurements of the egg, first instar larva, and head capsule width were made with aid of a stereomicroscope and a 0.1 mm scale. Measurements of the second instar and larger larvae, and pupae were made with a millimeter scale. Measurements of the head capsule width were made of the molted head capsules. Length measurements of the larvae were made when the larvae had quit eating and were preparing to molt. Maximum length of fifth instar larvae was measured during the most common resting position.

DESCRIPTION

Egg: Fusiform in shape: width: 0.43 mm (range 0.40 to 0.50) at middle, length: 1.21 mm (range 1.10 to 1.30). Each egg has longitudinal ribs with transverse ridges making them to appear as covered with tiny “ladders”; the base is a disk-like enlargement, the top is rounded; color: creamy white when oviposited, becoming orange red with a yellow tip in 3 days. Prior to hatching, the eggs turn brown with a black tip which is the black head of the larvae visible through the shell membrane. Eggs hatch in 4-5 days at room temperature.

Larva, general: *Colias johanseni* has five larval instars and exhibit one subdorsal stripe and one lateral stripe on each side. Second through fifth instars are similar and differ only in size. Only the first and fifth instars are fully described herein.

First instar: Head: black, bilobate in shape with tiny black hairs. Body: green anteriorly and becoming yellowish green posteriorly; sprinkled with tiny black dots from which rise short black hairs; middorsal stripe dark green; a yellowish tan band behind head with brown spot on each side of middorsum; a dark green area dorsally just above the anus; lateral stripes white; spiracles black, located at lower side of lateral stripe. Length at maturity: 3.21 mm (range: 2.80 to 3.35); width of head: 0.30 mm (range: 0.28 to 0.35).

Second instar: Length at maturity: 5.10 mm (range: 4.48 to 5.70); width of head: 0.50 mm (range 0.46 to 0.55).

Third instar: Length at maturity: 9.55 mm (range: 9.50 to 10.05); width of head: 0.90 mm (range 0.80 to 0.98).

Fourth instar: Length at maturity: 13.75 mm (range: 13.5 to 14.0); width of head: 1.44 mm (range: 1.40 to 1.50).

Fifth instar: Head: green with numerous short black hairs, bilobate in shape; eyes: black. Body: green with numerous short black tubercles from which rise short black hairs; tubercles arranged in bands across body, with five or six bands on each segment; middorsal stripe dark green; subdorsal stripes cream dorsally, white ventrally; lateral stripes white; on ventral side of the subdorsal stripes, and adjacent to the stripe, a black lunate spot where the segments join; dark area above anus; some of the morphological features are not expressed, or barely expressed, on the first thoracic segment and the last two abdominal segments; spiracles whitish with brown ring; thoracic legs: dark green and brown. Length at maturity: 22.1 mm (range: 21.5 to 22.5), width of head: 2.15 mm (range: 2.00 to 2.25).

Pupa: Head: protracted and beak like, very dark green to black, a white line immediately below the middle. Thorax and wing cases: dark green; a black line on the dorsal edge of each wing case from the base to inner margin, ventral side of this line light green; black patch near the center of the wing cases and black spot at discal cell. Abdomen: yellow green becoming more yellow ventrally; middorsal stripe dark green; sub-dorsal and lateral stripes white; midventral stripe thin, broken, and brown; a subventral brown stripe on each side of abdomen, adjacent to and above the lateral stripes are dark green patches on each segment; midway between the middorsal stripe and the sub-dorsal stripes on abdominal segments 1-3 is a small dark green spot. As the pupa develops, the colors and patterns of the adult are visible. Pupa is attached at distal terminus to a silk pad, and held loosely to the pupation site by a silk girdle. Length: 18 mm, width: 7 mm.

Behavior: Larvae like to leave the host plant and wander off to pupate. In the lab they would pupate upright on the side of the container or horizontally on the top of the container. In nature, they probably find another plant or rock on which to pupate. The area where *C. johanseni* lives is dry tundra dominated by modified drumlins. Males of both *C. johanseni* and *C. hecla* Strecker, 1880 patrol the south side of the drumlins as a mate locating behavior. The females of both species roam across the tundra searching for host plants on which to oviposit.

DISCUSSION

From the time the post diapause larvae started eating to emerging as adults was 16 days. All the larvae diapaused as fully grown third instar, so it appears that they would not exceed that stage in nature even if weather permitted. It is quite probable that most larvae do not reach that stage in nature due to the onset of cold temperatures. Overwintering *Colias eurytheme* in my Utah yard, began to eat on February 24 even though it was a rather cold winter and there were pupae by the end of March. Presumably post diapause *C. johanseni* larvae begin to eat early and develop fairly rapidly even when the weather is still quite cool.

Only six adults were obtained from this rearing, three males and three females. Most of the larvae died from overwintering. The three males have the androconial patch on the hind wing. This androconial patch is the primary distinction between *C. johanseni* and *C. hecla*. The three females are all intermediate in color and pattern with all females of both *C. johanseni* and *C. hecla* that were collected.

The natural life history, the mating and taxonomic relationship with *C. hecla* at Bernard Harbor remains to be studied. Due to the remote location and arctic conditions where *C. johanseni* inhabits natural studies would be rather difficult.

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LITERATURE CITED

Troubridge, J. and K. Philip. 1990. A new species of *Colias* from Arctic Canada. *Canadian Entomologist*, 122:15-20.



Figs. 1-12 Developmental stages of *Colias johanseni*. **Fig. 1.** Male: topotype. **Fig. 2.** Female: topotype. **Fig. 3.** Ovum. **Fig. 4.** First instar larva. **Fig. 5.** Fourth instar larva. **Fig. 6.** Diapausing third instar larva. **Fig. 7.** Fifth instar larva. **Figs. 8 & 9.** Freshly emerged reared female. **Fig. 10.** Pupa with female adult ready to emerge. **Fig. 11.** Pupa. **Fig. 12.** Prepupa. All photographs by Jack Harry. Figs. 1 & 2 actual size.