

THE BIOLOGY AND IMMATURE STAGES OF
AUTOMERIS RANDA AND *AUTOMERIS IRIS HESSELORUM*
(SATURNIIDAE)

PAUL M. TUSKES

7900 Cambridge 111D, Houston, Texas 77054

ABSTRACT. The biology and immature stages of *Automeris randa* and *Automeris iris hesselorum* are described for the first time. Mature larvae and adults of both species are illustrated and a key to the *Automeris* larvae of the United States is presented. *Automeris randa* occurs in the Peloncillo Mts. of Arizona and New Mexico. The larval food plants of *A. randa* include *Quercus* and *Celtis*. *Automeris iris hesselorum* has been collected near Pena Blanca Lake, Santa Cruz Co., Arizona. The larval food plants of *A. iris hesselorum* include *Quercus* and *Eysenhardtia polystachya*. Both species are single brooded in Arizona.

Although *Automeris* is a large neotropical genus, few members occur north of Mexico. To date, only six species of *Automeris* are known to occur in the United States and only one species, *Automeris io* (F.) is widely distributed. *Automeris io* occurs from southern Canada to Mexico and inhabits most of the contiguous states with the exception of those in the far west. *Automeris louisiana* Ferguson & Brou and *A. zephyria* Grote are endemic species, while *A. cecrops pamina* (Neumogen), *A. randa* Druce, and *A. iris hesselorum* Ferguson are primarily Mexican species that reach their northern limit of distribution in Arizona or New Mexico. Ferguson (1972) noted that the biology and immature stages of *A. iris hesselorum* were undescribed, and the occurrence of *A. randa* in the United States was not known until 1976, thus, this species was not illustrated or discussed by Ferguson. The purpose of this paper is to describe the biology and immature stages of *A. randa* and *A. iris hesselorum*.

Automeris randa

Automeris randa is widely distributed in Sonora and Chihuahua, Mexico, but in the United States is known only from the area near the Arizona-New Mexico-Mexico border. The first United States record was that of a male captured by Peter Jump in 1976 at Guadalupe Canyon, Cochise Co., in the Peloncillo Mts. of Arizona. Between 1976 and 1981 numerous trips were made to the area, but only a few additional males were captured. But, during this time, *randa* was also collected at Cottonwood Canyon, 1440 to 1600 m, Cochise Co., Arizona and Clanton Draw, 1660 m, Hidalgo Co., New Mexico by Jump. Both of these locations are also in the Peloncillo Mts. Then in 1982 and 1983 both males and females were captured by numerous collectors at Gua-

dalupe Canyon, and a specimen was taken in the same mountain range at Skeleton Canyon.

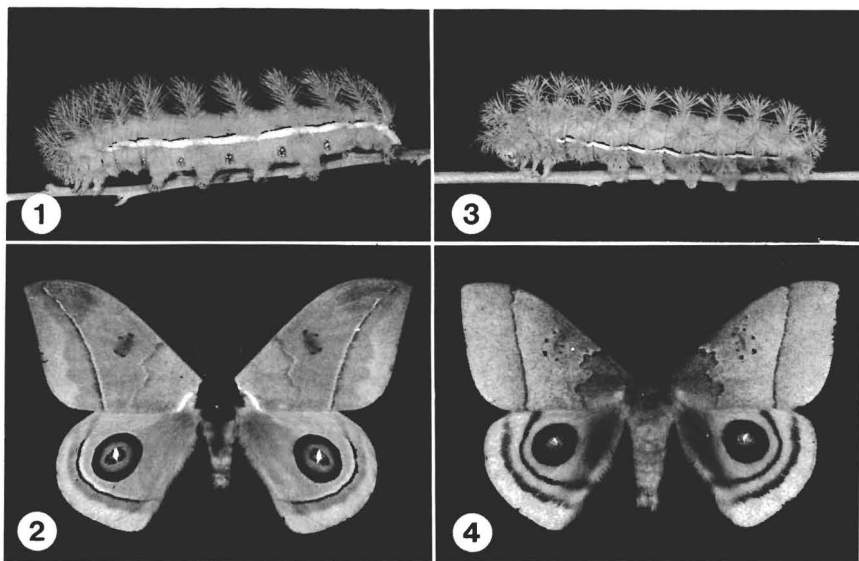
The adults (Fig. 2) have apricot colored forewings, while the marginal area is light brown. Some females have a slight purplish tint on the forewing. Two thin lines, yellow and brown, extend from near the apex of the forewing to the inner margin. The thin antemedial line is yellow and the base of the wing is dusted with white scales. On the hindwing, the margin is light brown and there is a reddish brown to orange submarginal band that is distal to a thin black and thin yellow line. The basal and medial hindwing area is orange, and surrounds a large multi-colored eyespot. The thorax is dark brown, and the abdomen is orange. Forewing length of the males ranges from 42 to 48 mm; females from 44 to 55 mm. According to LeMaire (pers. comm.), *randa* may represent a subspecies of *A. rubescens* Walker, but a change is not contemplated unless additional work is done on this complex.

Capture records from Arizona and New Mexico indicate that adults have been taken at lights between 30 June and 7 August. Based on these records, the peak flight appears to be from late July through early August. In captivity, adults emerged between 0900 and 1500 h. After wing expansion they remain quiescent throughout the day. Mating generally occurs after 2200 h and the pair remain together for about 45 min. The female begins the ovipositional flight the next night. The white eggs are deposited in clusters of 20 to 45 on the underside of the leaf.

The larvae feed gregariously until the 4th or 5th instar and then singly or occasionally in pairs. Early instar larvae are yellow but become green or blue-green at the onset of the 4th or 5th instar and develop a prominent yellow subspiracular line that is usually bordered on either side by a thin black and red line. The dorsal and dorsolateral scoli are relatively long and slant forward during the 5th–7th instars, giving the larva a distinct appearance (Fig. 1). Although little phenotypic variation was observed, it was found that the number of larval instars varied from 6 to 7. The larvae having the additional instar had larger head capsules and greater overall size and, thus, may have been females. First through last instar larvae collected in Guadalupe Canyon have been found on various oaks and hackberry, *Celtis pallida* Torr.

Prior to pupation, larval coloration may change from green to yellow or yellowish brown. In captivity all larvae pupated on the host plant by attaching leaves together and spinning a thin but tightly woven cocoon. Neither the cocoon nor the leaves are attached to the branch with silk and would have fallen into the leaf litter when the tree shed its leaves.

In addition to *A. randa*, other species of saturniids collected during



FIGS. 1-4. 1, mature larva of *A. randa* (0.65 \times); 2, male *A. randa* (0.65 \times); 3, mature larva of *A. iris hesselorum* (0.85 \times); 4, male *A. hesselorum* (1.0 \times).

late July at Guadalupe Canyon included: *Hyalophora gloveri*, *Eupackardii calleta*, *Antheraea polyphemus oculatea*, *Agapema galbina anona*, *Citheronia splendens*, *Anisota oslari*, *Sphingicampa hubbardi*, and *Automeris cecrops pamina*.

The larval description is based on 26 larvae reared from ova deposited by a female collected at Guadalupe in 1983 and on four second instar field collected larvae provided by Steve McElfresh in 1982 and reared to maturity by the author. Length and width measurements give the size range of larvae at the end of each instar.

Larval Description

First instar. Head: Diameter 1.0 mm. Color yellow. **Body:** Ground color yellow. Length 5.6 mm, width 1.0 mm. Dorsal scoli branched, shaft and spines yellow with black tips. Dorsolateral, lateral and sublateral scoli yellow. Dorsal, lateral and ventral surfaces yellow. Thin mid-dorsal brown line extends from mesothorax to caudal segment. True legs and prolegs yellow.

Second instar. Head: Diameter 1.7 mm. Color yellow. **Body:** Ground color yellow. Length 10 mm, width 1.6 mm. Dorsal scoli yellow, spines with black tips. Dorsolateral, lateral and sublateral scoli yellow. Two thin black lines extend length of larva. Mid-dorsal line extends from metathoracic segment (T3) to last abdominal segment (A9). Lateral line mid-way between dorsolateral and lateral scoli extending from T3 to A9; interrupted by yellowish brown intersegmental area. Dorsal, lateral and ventral surfaces yellow. True legs and prolegs yellow.

Third instar. Head: Diameter 2.4 mm. Color yellow. **Body:** Ground color yellow. Length 13-15 mm, width 2.1 mm. Dorsal and dorsolateral scoli branched, shaft and

spines yellow, some with black tips. Lateral and sublateral scoli branched and yellow. Three thin black lines extend length of larva. Mid-dorsal and dorsolateral lines as in second instar. Black spiracular line extends from T1 to A9. Dorsal, lateral and ventral surfaces yellow. Spiracles black. True legs and prolegs yellow.

Fourth instar. Head: Diameter 3.0 mm. Color yellowish green. Clypeus light brown. **Body:** Ground color yellowish green. Length 19–21 mm, width 4.5 mm. Dorsal and dorsolateral scoli yellow, tip of shaft and spines black. Lateral and sublateral scoli branched, shafts and spines yellowish green. Dorsal and lateral surfaces with numerous thin lines extending length of larva. Line I, mid-dorsal black line bordered on either side by thin yellow line. Line II, greenish gray line passes just below base of each dorsolateral scoli. Line III–IV, two lines, yellow above black, pass between dorsolateral and lateral scoli. Dorsal projection from black line disrupts yellow line as it pass each scoli. Line V, gray-green line connects base of each lateral scoli. Line VI, yellow line passes just ventral to line V and lateral scoli. Ventral surface gray-green. Spiracles black. Prolegs light yellow with light brown shields. True legs gray-green.

Fifth instar. Head: Diameter 4.1–4.7 mm. Color green to blue-green with short white setae. Clypeus cream. **Body:** Ground color green to blue-green. Length 27–34 mm, width 8–9 mm. All scoli shafts and spines match ground color. Dorsal and dorsolateral thoracic scoli shafts with upper $\frac{1}{4}$ black. Dorsal abdominal scoli with black tips on some spines. Lateral and sublateral scoli reduced in size. Lighth bluish gray mid-dorsal line extending length of larva and edged by thin light yellow on either side. Thin short black line extends from base of dorsolateral scoli to dorsal scoli and then between dorsal scoli. Black spiracular line thin and disrupted by base of spiracle, subspiracular yellow and black spiracular lines extend from T3 to A9. Small red patch with short white setae extending from cream colored pinaculum in intersegmental area of sublateral surface just anterior of each proleg and on A7. Anal and proleg shields light brown to light orange with numerous short white setae extending from cream colored pinaculum. Prolegs and ventral surface green. Spiracles light brown. True legs light orange.

Sixth instar (Fig. 1). **Head:** Diameter 5.5–5.9 mm. Color green to blue-green with short white setae. Clypeus cream. **Body:** Ground color green or blue-gray. Length 52–56 mm, width 12 mm. Dorsal and dorsolateral scoli enlarged (7 mm) with thin shafts and numerous long thin spines (4 mm). Lateral and sublateral scoli reduced (2–2.5 mm) in size. All scoli match ground color; no black tipped spines present as in previous instar. Short black vertical bar occurs between the dorsal and dorsolateral scoli. Broad yellow subspiracular line below thin black spiracular line which is disrupted by lower edge of spiracle. Ventral edge of subspiracular line often thinly edged with black and red. Both lines extend from anterior edge of T3 to A9. Red patch with short white setae extending from cream colored pinaculum in intersegmental area of sublateral surface just anterior to each proleg and A7. Anal and proleg shields reddish brown with white setae extending from cream colored pinaculum. Spiracles light orange. True legs brownish orange.

Seventh instar. Head: 7.9–8.1 mm. Color and comments same as previous instar. **Body:** Length 72–78 mm, width 17–19 mm. Ground color green or blue-gray. Dorsal and dorsolateral scoli; shafts 9–11 mm, spines to 6 mm. There is no noticeable difference between sixth and seventh instar larvae, other than overall size.

Automeris iris hesselorum

Like the previous species, *Automeris iris hesselorum* has an extremely limited distribution in the United States. Ferguson (1972) illustrated the adults in color and indicated that all of the Arizona records were from Pena Blanca Lake, Santa Cruz Co. This species was taken with some frequency until 1969, but available records suggest that none have been captured at Pena Blanca Lake since 1972. In addition to Pena Blanca Lake, a single specimen has been taken at San Rafael Valley, Cochise Co., Arizona. The dates of capture range from

mid July to early August. Similarly, a large series taken in Temoris, Sonora, Mexico were collected between 19 July and 8 August. The flight period probably extends for a week or two on either end of the known season.

The adults are easy to separate from the other two species of *Automeris* occurring in Arizona. *Automeris iris hesselorum* has a wing shape similar to that of *Automeris io*. The forewings are brownish pink, and the dark brown postmedial line extends from the costa to the inner margin in a straight line and remains the same distance from the wing margin (Fig. 4). The wing span of the male varies from 57 to 65 mm; female from 68 to 74 mm. The forewings of *A. randa* and *pamina* are falcate or pointed and the yellowish medial line extends diagonally from near the apex to about midpoint on the inner margin of the wing.

It would appear that the larvae of *hesselorum* utilize a wide variety of food plants. Ron Wielgus (pers. comm.) collected a late instar *hesselorum* larvae on an unidentified species of oak at Pena Blance Lake in 1968. During this same period, larvae were reared in captivity on various *Quercus* species, and desert willow, *Chilopsis linearis* (Cav.) which is in the family Bignoniaceae and not related to willow as the common name suggests. Larvae of *hesselorum* were collected in Mexico on Kidneywood, *Eysenhardtia polystachya* (Ort.) but when transferred to oak failed to survive (Steve Prchal, pers. comm.).

First through 4th instar larvae are a uniform golden yellow and their bodies are slightly tapered at each end. Early instar larvae feed gregariously on the underside of the leaves. Fifth and 6th instar larvae are green and appear somewhat similar to larvae of *Automeris io*. Mature larvae have a prominent white subspiracular line below thin black and red lines that extend from the first abdominal segment to the caudal segment (Fig. 3). The larval description is based on three larvae reared to maturity by the author on oak. The three fertile ova were received from Steve Prchal, who had collected a female *iris hesselorum* in Sonora, Mexico.

Larval Description

First instar. Head: Diameter 0.9 mm. Color golden yellow. **Body:** Ground color golden yellow. Length 4.9 mm, width 1.2 mm. Scoli coloration matches ground color.

Second instar. Head: Diameter 1.7 mm. Color golden yellow. **Body:** Ground color golden yellow. Length 11 mm, width 2.1 mm. Scoli coloration matches ground color.

Third instar. Head: Diameter 2.5 mm, color golden yellow. **Body:** Ground color golden yellow. Length 21–24 mm, width 4.5 mm. All scoli with golden yellow spines and shafts. Dorsal and dorsolateral scoli with some spines tipped with black. Light blue-gray mid-dorsal line extends from metathorax (T3) to caudal abdominal segment (A9). True legs, prolegs and spiracles golden yellow.

Fourth instar. Head: Diameter 3.8–4.0 mm. Color golden yellow. **Body:** Ground color

yellowish green. Length 26–29 mm, width 6 mm. All scoli golden yellow, dorsal and dorsolateral scoli with black tips on some spines. Light bluish gray mid-dorsal line extends from T3 to A8. Yellow subspiracular undulating fold extends from A1 to A8. Small red patch with golden pinaculum in intersegmental area of sublateral surface just anterior of each proleg. Spiracles gold. True and prolegs yellowish green.

Fifth instar. Head: Diameter 4.9 to 5.2 mm. Color green, adfrontal suture traced in brown. **Body:** Ground color green. Length 34 mm, width 9 mm. All scoli green, $\frac{1}{2}$ or fewer of spines tipped with black. Thin red and black partially broken subspiracular line dorsal to broad white lateral line which may be edged in red on lower edge. Broad white and thin red lateral lines interrupted by lateral scoli. All three lateral lines (black, white and red) extend from posterior edge of T3 to A8. Small red patch with green pinaculum occur in intersegmental area of sublateral surface just anterior to each proleg and on A7. Dorsal surface green to bluish green, lateral and ventral surfaces green. Proleg shields reddish. Spiracles light brown. True legs green.

Sixth instar. Head: Diameter 6.4–6.8 mm. Color and comments same as in previous instar. **Body:** Length 61 mm, width 12 mm. Ground color green. There is no noticeable difference between the fifth and sixth instar larvae other than overall size and a slight difference in the lateral lines. The black subspiracular line of the previous instar becomes red in the intersegmental areas and black only on the segment. A thin red line borders the ventral edge of the yellow lateral line.

Key to the Last Instar *Automeris* Larvae of the United States

1. Prolegs green; shields red or green. Prominent, continuous straight lateral yellow, white or red spiracular or subspiracular line extends from metathorax or abdominal segment 1 (A1) to A8 or beyond. Ventral surface primarily green **2**
 - Prolegs black, shields red or brown. White spiracular or subspiracular line broken or absent. Ventral surface black or red **5**
2. Spiracular or subspiracular lines white and red. Dorsal and dorsolateral abdominal scoli rosette type, shaft less than 5 mm long **3**
 - Subspiracular line yellow, bordered dorsally by thin black line. Spiracular line absent. Dorsal and dorsolateral abdominal scoli shafts slant anteriorly, shaft length 9–11 mm. (Arizona & New Mexico) *A. randa* Druce
3. True legs pink or red. Prolegs green; shields pink or red. Spiracular line red **4**
 - True legs green. Prolegs and shields green. Spiracular line absent. Subspiracular line white, bordered by thin red or red and black line. (Arizona) *A. iris hesselorum* Ferguson
4. Abdominal spiracles contained within red spiracular line. (Louisiana & Mississippi) *A. louisiana* Ferguson & Brou
 - Abdominal spiracles protrude from upper edge of red spiracular line. (various subspecies, widespread) *A. io* (F.)
5. Dorsal abdominal area yellow with numerous black and light yellow lines extending length of larva. Two lateral white lines are interrupted by vertical yellow lines connecting lateral and

- dorsolateral scoli. Scoli yellow and black. (New Mexico & western Texas) *A. zephyria* Grote
- Dorsal abdominal area with numerous black, blue-gray or white lines extending length of larva. Diagonal white lines on lateral surface extend from base of dorsolateral scoli to lateral scoli on succeeding segment. Scoli blue-gray and black. (Arizona & New Mexico) *A. cecrops pamina* (Neumoegen)

Discussion

To a greater extent than in any other state, the saturniid fauna of Arizona is significantly influenced by that of Mexico. Southern Arizona represents the most northern range of many Mexican plants, reptiles, birds, and insects (Lowe, 1964). The typically Mexican saturniid species such as *Citheronia splendens sinaloensis* Hoffmann, *Eacles oslari* Rothschild, *Sphingicampa montana* (Packard), *Sphingicampa albolineata* (Grote & Robinson), *Adeloneivaia isara*, *Rothschildia cinctus* Tepper, *Automeris randa*, and *Automeris iris hesselorum* usually occur from 20 to no further than 80 km north of Sonora, Mexico. Other quasi-Mexican species [*Anisota oslari* Rothschild, *Sphingicampa hubbardi* (Dyar), *Hemileuca tricolor* (Packard), *Automeris cecrops pamina* (Neumoegen), *Eupackardi calleta* (Westwood), and *Agapema galbina anona* (Ottolengui)] tend to be relatively abundant and with the exception of *H. tricolor*, occur from Arizona to Texas.

The Mexican species that occur in Arizona can be placed into three categories: dependable resident, undependable resident, and temporary resident. *Citheronia splendens* and *Eacles oslari* are examples of dependable residents. They are not necessarily common but represent species that are found each year. Undependable residents include *Rothschildia cinctus*, *Sphingicampa albolineata*, and *Sphingicampa montana*. These are permanent residents which are infrequently captured, because they occur in isolated areas, generally have low population levels, and lack biological and habitat data. For example, seven blacklight stations were set up in the southern branch of Pena Blanca Canyon and operated for two consecutive nights. Each station had two to three 15 watt blacklights and was separated from the next station by 75 to 100 m. One *R. cinctus* and two *S. montana* were captured; both *montana* were taken at the same light. On the third and fourth nights a mercury vapor light was operated, and nearly a dozen *montana* were captured. If each station had been operated by a different collector, most might have been assumed that neither *S. montana* nor *R. cinctus* were present. Collecting techniques, location, experience, persistence, and chance interact to influence the collector's perception of species abundance and distribution.

Automeris randa is probably best described as an unpredictable resident. The fact that *randa* occurs over a wide area within the Peloncillo Mountains of Arizona and New Mexico suggests it is well established. This species probably remained uncollected due to the isolation and inaccessibility of its habitat. During a trip to Guadalupe Canyon we traveled for over 20 miles on unmarked dirt roads and after arriving, found that only vehicles with high road clearance could actually enter the canyon.

Automeris iris hesselorum and *Adeloneivaia isara* are the most recent, but perhaps not the only, examples of temporary Arizona residents. Specimens of *Citherona mexicana* (Grote & Robinson) and *Sphingicampa albolineata* were labeled "Cochise Co., Arizona" and *Hylesia coinopus* Dyar as "So. Arizona/Poling" and are treated as mislabeled or with suspicion. The ephemeral nature of these species may be influenced by seasonal variation in the weather of northern Sonora and southern Arizona. Perhaps a succession of favorable winters and summers allows the temporary/ephemeral species to become established in Arizona, but periodically, climatic conditions exceed their tolerances, causing local extinction. Based on the observation that *S. albolineata* is now known to be a resident species in Cochise Co., the ephemeral nature of *A. iris hesselorum* and *A. isara*, and the recent discovery of *A. randa*, the past occurrence of *Citheronia mexicana* and *Hylesia* seem more likely.

ACKNOWLEDGMENTS

I wish to thank Peter Jump, Steve Prchal, and Ron Wielgus for their observations, and Steve McElfresh, Scott Meredith, Tom Carr, and Jim Tuttle for accompanying the author on Arizona trips, and for sharing ova and observations. I would also like to thank Ann McGowan-Tuskes and Mike Collins for their comments on the manuscript.

LITERATURE CITED

- FERGUSON, D. C., in Dominick, R. B. et al. 1972. The moths of America north of Mexico, Fasc. 20.2B, Bombycoidea (in part).
LOWE, C. H. 1964. Arizona's natural environment. Univ. Ariz. Press. 136 pp.