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NOTES ON THE LIFE HISTORY OF *ANETIA JAEGERI* FROM HISPANIOLA (LEPIDOPTERA: NYMPHALIDAE: DANAINAE)

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ABSTRACT.– Early stages of the endemic Hispaniolan danaid butterfly *Anetia jaegeri* (Ménétriès) (Lepidoptera: Nymphalidae), are described, and *Asclepias nivea* L. (Asclepiadaceae) is reported as being its food plant. Morphology of the last instar larva is examined for systematic implications, utilizing characters previously developed by Kitching (1985) for other danaines. *Anetia jaegeri* is found to be the most primitive of the 16 analyzed species of Danainae.

KEY WORDS: Asclepiadaceae, biology, Caribbean, cladistic analysis, *Danaus*, Dominican Republic, immature stages, Ithomiinae, larvae, life history, *Lycorea*, *Methona*, Neotropical, pupae, West Indies.

There are eight species of Danainae known from the island of Hispaniola: *Danaus plexippus megalippe* (Hübner), *D. gilippus cleothera* (Godart), *D. eresimus tethys* (Forbes), *D. cleophile* (Godart), *Lycorea cleobaea cleobaea* (Godart), *Anetia briarea briarea* (Godart), *A. pantherata pantherata* (Martyn), and *A. jaegeri* (Ménétriès) (Schwartz, 1988). This is the highest diversity for this subfamily in the New World (8 of 14 species). Part of this diversity could result from the high diversity of potential hostplants on this island: 31 endemic species in 9 genera of Asclepiadaceae (Brower *et al.*, 1992).

Until very recently, information on the biology of the genus *Anetia* was absent. Ackery and Vane-Wright (1984) wrote:

> "Virtually no reliable data have been published on any aspect of their biology, and a thorough investigation of these butterflies would be of considerable scientific value. . . . *Anetia* is the only genus within Danainae for which reliable early stage information is lacking. Food-plant data and larval tubercle configuration would be valuable — the latter particularly in view of Forbes' 1939 assertion that *Anetia* should be treated as the sister of all other Danainae on the basis of supposed (but we think unlikely) total lack of larval tubercles."

Brower *et al.* (1992) illustrated the life history of *Anetia briarea*, whose larvae were raised on a substitute hostplant of Florida milkweed vine, *Cynanchum angustifolium* (Asclepiadaceae), from eggs obtained in captivity. On Hispaniola, the natural hostplant for this species is *Cynanchum* sp. (Sourakov, unpublished). In 1993, the life history of *Anetia thirza thirza* (Geyer) from Mexico was described, and its food plant was reported as being a vine: *Metastelma pedunculane* (Asclepiadaceae) (Llorente-Bosquets *et al.*, 1993). That confirmed earlier observations on *A. thirza insignis* (Salvin) in Costa Rica (DeVries, 1987). John E. Rawlins (pers. com.) raised *A. jaegeri* on *Asclepias* (Asclepiadaceae) and David K. Wetherbee (pers. com.) observed females ovipositing on the vine *Cynanchum*. In the present work, the first published native hostplant record for *Anetia jaegeri* is provided. We also compare its immature stages to those of *A. briarea*. The larva and pupa of *A. thirza* seem to be very similar to those of *A. jaegeri*, which, probably, reflects their taxonomic closeness.

Detailed study of the morphology of the immature stages of other Danainae previously had proved to be useful for reconstruction of the evolutionary history of this subfamily. Kitching (1985) recreated the evolutionary history of Danainae primarily on the basis of the larval morphology. His data set for the subfamily's larvae with the addition of the same characters from *Anetia jaegeri* was analyzed using the PAUP computer program. In Table 1, the complete data set for 77 larval characters utilized by Kitching is provided. We were able to score 62 of them in *Anetia jaegeri*. Missing characters are marked as "?". Our data are incomplete due to the lack of material: a single head capsule left after pupation of our sole larva was used to obtain characters for the cladistic analysis. We do not elaborate here on the characters utilized for the cladogram construction: they are discussed thoroughly in Kitching's work. We do, however, provide micrographs of larval organs, illustrating some of the characters utilized (Fig. 3). All characters listed in Table 1 are in the same sequence as Kitching's 77 binary/multistate larval characters, L1-L77.

DESCRIPTION OF LIFE HISTORY

In September 1995, the senior author collected danaine eggs on *Asclepias nivea* L. (Asclepiadaceae) host plants above Mata Grande, Santiago Province, at the elevation of 1500m in the Cordillera Central of the Dominican Republic, Hispaniola. Most hatched into larvae of *Danaus cleophile* or *Danaus plexippus*, with yellow-and-black striping and two pairs of tubercles. One of the eggs hatched into a larva with black-and-white striated dorsum and only one pair of black mesothoracic tubercles; this larva later metamorphosed into a female adult (Fig. 1: bottom left) of *Anetia jaegeri*.

The larva of *A. jaegeri* maintains the same pattern throughout the whole development period. In its early instars, it resembles fourth instars of *A. briarea*, illustrated by Brower *et al.* (1992). However, *A. jaegeri*'s larva has uniform fine black-and-white

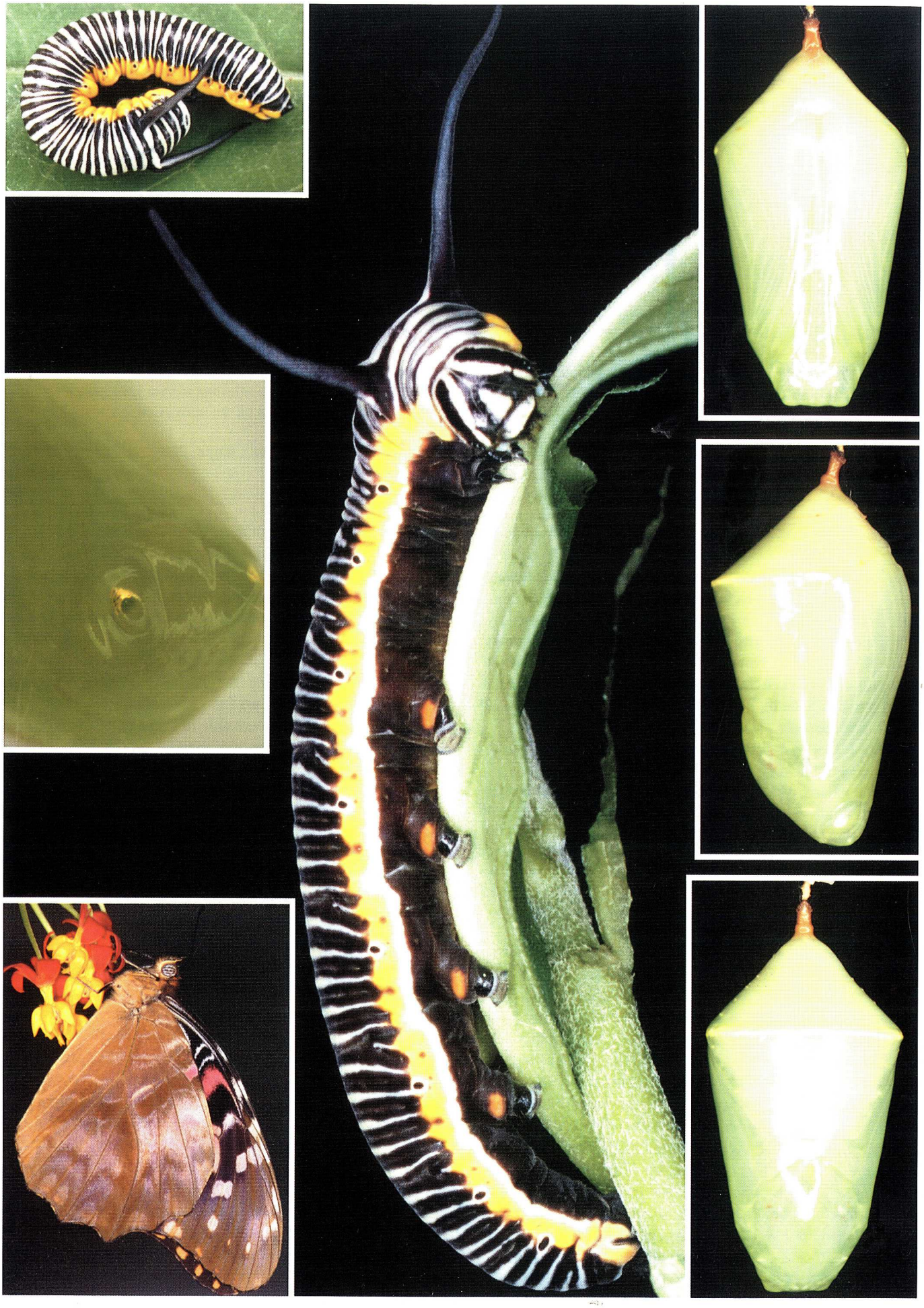

TABLE 1. Kitching's (1985) data set of scored larval characters re-run on PAUP with the additional taxon of *Anetia jaegeri.* The 77 characters, reading from left to right, correspond to L1-L77 of Kitching. (0,1,2,3,4 = character states as scored by Kitching for species 1-15 and 17, and by Sourakov for species 16; * = not comparable; ? = missing data). *Methona themisto* (Hübner) (Ithomiinae) is used as an outgroup.

TAXA	CHARACTER STATES
1.[Danaus chrysippus]	22002 01210 21010 12010 10101 00021 10000 11001 00010 00101 20110 00010 00012 10001 11100 00
2.[Danaus gilippus]	31002 01210 21010 12010 10101 10021 10000 11001 00010 00101 20110 00010 00012 10001 11100 00
3.[Danaus affinis]	22002 02210 21010 12001 10101 10021 10000 11001 01010 00101 20110 00010 00012 10001 10000 10
4.[Danaus philene]	32002 02210 21010 12001 10101 10021 10000 11001 00010 00101 20110 00010 10012 10001 10000 10
5.[Danaus erippus]	32002 01220 31000 12001 20101 10011 10000 11001 00010 00201 20110 10010 00012 10001 10010 00
6.[Danaus plexippus]	32002 01220 31000 12001 20101 10011 10000 11001 00010 00201 20110 10010 00012 10001 10010 00
7.[Tirumala hamata]	22002 02110 31000 12001 10101 10011 00000 11011 00010 00101 20110 00010 00112 10000 10100 00
8.[Tirumala ishmoides]	23002 02012 31000 12001 10101 10001 00000 11011 02012 00101 20110 00010 00112 10000 00000 00
9.[Tirumala limniace]	21102 01010 31000 12001 10101 10011 00000 11011 00010 00101 20110 00010 00012 10000 10000 00
10.[Amauris ochlea]	30102 11201 01111 10000 00010 00020 10000 00010 00000 10001 10020 00000 10012 00000 00020 00
11.[Amauris albimaculata]	32122 11103 01111 10001 00000 00001 10000 10010 00000 10001 20020 00010 10012 00010 00020 00
12.[Ideopsis juvenata]	11102 02111 31000 10001 10000 01111 01000 11001 00010 10200 20110 00111 00110 10000 00000 00
13.[Parantica aspasia]	30112 02211 31000 11000 10001 10011 10000 01011 00010 00201 20110 00100 00012 10000 00000 00
14.[Euploea treitschkei]	21322 01100 11110 10000 00001 10001 00100 11011 10010 00111 10110 00010 00012 10000 10000 00
15.[Euploea leucostictos]	21321 02000 11110 10000 00001 10001 00100 11011 00010 00102 10110 00010 00012 10100 10100 00
16.[Anetia jaegeri]	3?32? 02?20 *1000 02001 11101 ??001 10001 11??? ?0?10 0010? ?0010 ?1??? 01001 01000 00001 01
17.[Methona themisto]	00000 00000 40000 001** ****0 0*000 *0011 00100 00101 01000 01001 01000 01001 01000 00001 01

striations (total of 51 stripes) (Fig. 1: top left), while the larva of *A. briarea* has only eleven equidistant distinctive white stripes, separated by areas where the white striation is washed out. These areas turn brown in the last instar of *A. briarea,* while the *A. jaegeri* larva remaines entirely striated (Fig. 1: middle). Spiracular stripes in both species are yellow; however, the white subspiracular stripe, which is present in *A. briarea* in both the fourth and fifth instars, is absent in the fourth instar and much more narrow in the fifth instar of *A. jaegeri.* Head capsules are similar in both species, except for vertical black stripes being a little wider in *A. jaegeri.* (Fig. 1: middle). Chaetotaxy of the head, first thoracic and last abdominal segments of the last instar larva is shown in the Fig. 4.

One of the interesting aspects of larval behavior is shown in the top left corner of Fig. 1. When resting and especially when irritated, the larva coils, resembling the behavior of Ithomiinae larvae.

The prepupa maintains similar striation, but the ground color becomes green and the spiracular stripe is vague. A white transverse band separates the larva in two halves at the third abdominal segment level. This is, probably, a prototype of the pupal transverse band on the abdominal ridge.

The pupa of *A. jaegeri* (Fig. 1: right) is light green in ground color, resembling that of *A. briarea.* The transverse ridge on the abdomen is yellow rather than gold. In the first of the obtained pupae, no gold spots were observed. However, in December 1995 the junior author collected three additional larvae on a trip to Dominican Republic. One of the new pupae had a tiny gold spot on each tip of its eye-pieces (Fig. 1: middle left). In the other pupa, both eye-piece gold spots and even smaller thoracic gold spots were present.

Larvae were raised in the laboratory at 20°C on *Asclepias curassavica.* Development took 30 days: four days in the egg stage, 14 days in the larval stage, and 12 days in the pupal stage.

Fig. 1. Stages of *Anetia jaegeri*: **Top left**: fourth instar larva; **Middle left**: Close-up of gold spots of the pupal eye-pieces; **Bottom left**: Female adult; **Middle**: Last instar larva on the food plant of *Asclepias nivea*; **Top right**: pupa, ventral view; **Middle right**: pupa, lateral view; **Bottom right**: pupa, dorsal view.

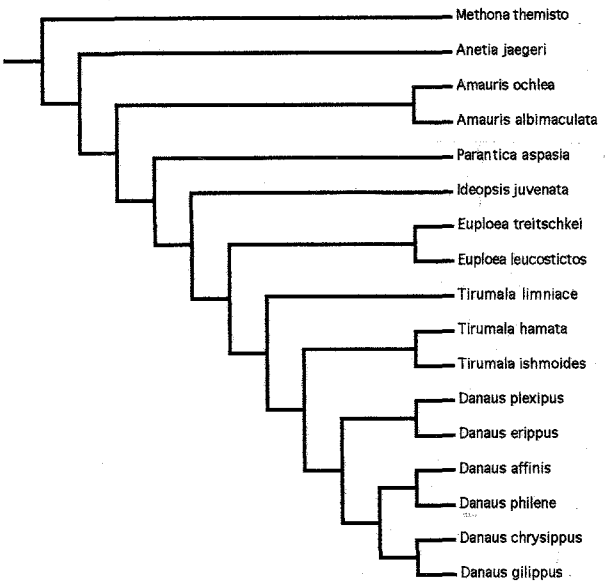

Fig. 2. Cladogram derived from Kitching's (1985) larval data set on Danainae with additional taxon of *Anetia jaegeri.*

CONCLUSIONS

Brower *et al.* (1992) found that *Asclepias curassavica* (which we successfully used as a substitute food plant), as well as three other species of *Asclepias,* were not accepted by larvae of *Anetia briarea. Asclepias curassavica* and *A. incarnata* appeared to be even toxic to first-instar larvae. Larvae of *A. briarea* were therefore raised on a milkweed vine, *Cynanchum angustifolium.* These observations, combined with our data, suggest that in nature different species of *Anetia* are capable of utilizing different milkweed species with different degrees of toxicity. Such adaptation could have led to radiation of the genus on Hispaniola in the first place.

Cladistic analysis of the larval set of characters (Table 1), derived from Kitching (1985) and our present data, leads to the conclusion that *Anetia jaegeri* is the most primitive among analyzed members of the subfamily (Fig. 2), confirming similar

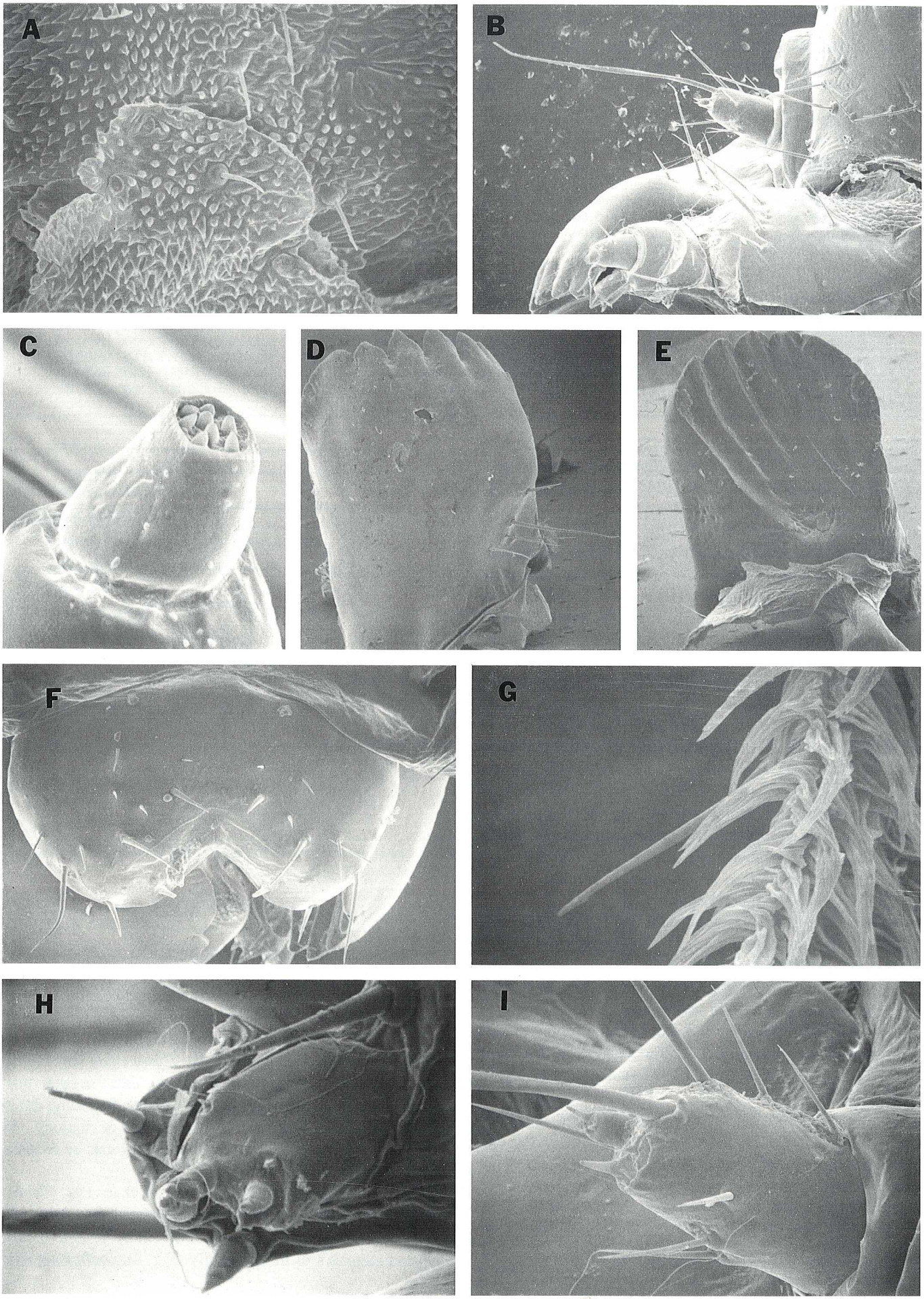
A
B
C
D
E
F
G
H
I

Fig. 4. Head, first thoracic and last abdominal segments of the last instar larva of *Anetia jaegeri.*

conclusions reached by Brower *et al.* (1992). All of the analyzed Danainae taxa are more closely related to each other than to *Anetia.* Not being specialists in the group, we are not attempting to further discuss *Anetia*'s taxonomic position in Danainae.

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Fig. 3. Scanning electron micrographs of fifth instar larva of *Anetia jaegeri*: (A) Surface of the body (250x); (B) Mouthparts (75x); (C) Maxillary palp segment 3 (1000x); (D) Mandible, aboral view (75x); (E) Mandible, oral view (75x); (F) Labrum (100x); (G) Surface of the tubercle (750x); (H) Galea (350x); (I) Antenna (500x).

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