

## THE LARVAL INSTARS OF *ORTHEMIS NODIPLAGA* KARSCH, 1891 FROM ARGENTINA (ANISOPTERA: LIBELLULIDAE)\*

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The last 10 larval instars are described and illustrated, and the final instar is compared with that of *O. ferruginea* (Fabr.).

### INTRODUCTION

Five species of the genus *Orthemis* Hagen have been reported for Argentina, viz. *O. ambinigra* Calvert, *O. nodiplaga* Karsch, *O. cultriformis* Calvert, *O. flavopicta* Kirby and *O. ferruginea* (Fabricius). The latter is the only one of which larval instars have been described (NEEDHAM 1904; CALVERT, 1927; GEIJSKES, 1935; NEEDHAM & WESTFALL, 1955).

This paper includes the description of the larval instars of *O. nodiplaga*. This is a widespread species in Argentina where it occurs in the provinces of Misiones, Corrientes, Chaco, Tucumán, Santiago del Estero, Buenos Aires, Entre Rios and San Luis. Larvae dwell either in lentic (permanent or temporary) or in lotic environments, the latter with little current. They move slowly on the bottom, allowing the settlement of different kinds of epibionts as well as detritus on their abundant pilosity.

### METHODS

Specimens studied were captured simultaneously and different instars sorted according to observed differences (see below). In addition a number of individuals were reared in order to compare their characteristics with the ones recorded from field captures. Live larvae were condi-

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tioned as indicated in RODRIGUES CAPITULO (1980, 1983); dead specimens were preserved in 80 % alcohol.

DESCRIPTION

Maximum head width and fore wing pad length were correlated in all instars after F-7. In this way separate groups were obtained, each corresponding to a different instar. Wing pads appear from the F-7 instar onwards.

Meristic data were tabulated and illustrated for all analyzed instars (Tabs I-V, VI; Fig. 1). Chaetotaxia changes on the legs and mask of all instars are illustrated in Figures 2 and 3, respectively. A detailed description is given only for the final instar (F).

Table I  
Delimitation of larval instars — [ $\bar{X}$  = mean (mm); — S = standard deviation]

| Character measured | Instar and number examined |          |           |           |          |           |          |          |          |          |
|--------------------|----------------------------|----------|-----------|-----------|----------|-----------|----------|----------|----------|----------|
|                    | F<br>18                    | F-1<br>7 | F-2<br>13 | F-3<br>25 | F-4<br>9 | F-5<br>28 | F-6<br>1 | F-7<br>7 | F-8<br>1 | F-9<br>1 |
| Head width         | $\bar{X}$                  | 4.86     | 3.55      | 2.53      | 2.07     | 1.84      | 1.59     | 1.35     | 0.98     | 0.63     |
|                    | S                          | 0.13     | 0.09      | 0.11      | 0.09     | 0.08      | 0.10     | —        | 0.05     | —        |
| Length of wingpads | $\bar{X}$                  | 7.01     | 3.45      | 1.75      | 1.09     | 0.84      | 0.53     | 0.30     | 0.12     | —        |
|                    | S                          | 0.24     | 0.18      | 0.08      | 0.09     | 0.07      | 0.06     | —        | 0.03     | —        |

Table II  
Head dimension (in mm)

| Instar | Width  | Length | Width/<br>length | interocular<br>width | Eye<br>anteropost.<br>length | postocular<br>length | scape | Antenna |           |      |      |      |      |      | Total |
|--------|--------|--------|------------------|----------------------|------------------------------|----------------------|-------|---------|-----------|------|------|------|------|------|-------|
|        |        |        |                  |                      |                              |                      |       | pedicel | flagellum | 1    | 2    | 3    | 4    | 5    |       |
| F      | X 4.79 | 3.16   | 1.51             | 0.99                 | 1.13                         | 1.53                 | 0.35  | 0.30    | 1.99      | 0.50 | 0.28 | 0.41 | 0.41 | 0.39 | 2.64  |
|        | S 0.10 | 0.07   |                  | 0.66                 | 0.12                         | 0.09                 | 0.05  | 0.08    | 0.02      | 0.05 | 0.05 | 0.04 | 0.04 | 0.11 |       |
| F-1    | 3.60   | 2.40   | 1.15             | 1.10                 | 0.90                         | 1.00                 | 0.30  | 0.30    | 1.70      | 0.40 | 0.25 | 0.30 | 0.45 | 0.30 | 2.30  |
| F-2    | 2.50   | 1.70   | 1.47             | 1.10                 | 0.70                         | 0.90                 | 0.20  | 0.25    | 1.32      | 0.25 | 0.12 | 0.28 | 0.30 | 0.37 | 1.77  |
| F-3    | 2.10   | 1.50   | 1.40             | 1.00                 | 0.50                         | 0.80                 | 0.18  | 0.21    | 0.90      | 0.15 | 0.13 | 0.20 | 0.22 | 0.20 | 1.29  |
| F-4    | 1.94   | 1.40   | 1.38             | 0.90                 | 0.45                         | 0.70                 | 0.18  | 0.20    | 0.90      | 0.18 | 0.12 | 0.20 | 0.20 | 0.20 | 1.28  |
| F-5    | 1.50   | 1.00   | 1.50             | 0.85                 | 0.40                         | 0.50                 | 0.17  | 0.15    | 0.75      | 0.11 | 0.09 | 0.15 | 0.20 | 0.20 | 1.07  |
| F-6    | 1.35   | 0.90   | 1.50             | 0.75                 | 0.30                         | 0.45                 | 0.10  | 0.15    | 0.60      | 0.10 | 0.08 | 0.15 | 0.15 | —    | 0.85  |
| F-7    | 1.05   | 0.70   | 1.50             | 0.50                 | 0.25                         | 0.35                 | 0.08  | 0.10    | 0.50      | 0.10 | 0.10 | 0.15 | 0.17 | —    | 0.68  |
| F-8    | 0.63   | 0.38   | 1.66             | 0.42                 | 0.14                         | 0.19                 | 0.05  | 0.06    | 0.21      | 0.08 | 0.14 | —    | —    | —    | 0.32  |
| F-9    | 0.50   | 0.34   | 1.48             | 0.29                 | 0.11                         | 0.15                 | 0.05  | 0.06    | 0.18      | 0.07 | 0.11 | —    | —    | —    | 0.29  |

FINAL INSTAR  
Figures 4-9

Material. — Argentina, Buenos Aires province, Bosques: 9 larvae, IV-1981; 4 larvae, IX-1984; 1 larva, VI-1986; — Gonnet: 96 larvae, VI-1986, A. Rodrigues Capitulo leg. — All material is deposited in the Museo de La Plata Collection of Arthropods (UNLP).

Head. — Maximum width (in mm):  $4.85 \pm 0.13$ ; maximum length:  $3.16 \pm 0.07$ ; — width/length ratio: 1.46.

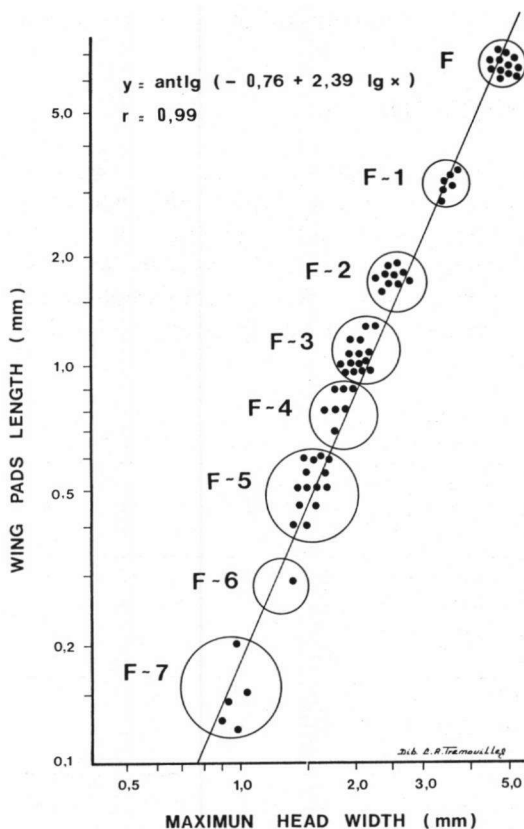


Fig. 1. *Orthemis nodiplaga*: the relationship between fore wing pad length and maximum head width, logarithmic scale.

Ocelli indicated by abundant pilosity, little apparent, median one more evident. Labium green. Labial palps (Fig. 8-9) with numerous basal, dorsal, short setae, and 4-5 spiniform setae of 0.2 mm on each distal crenula oriented ventrad.

Maxilla with seven spines, the two distal ones denticulated with an accessory (0.3 mm length) tooth, or a bifid one, with the branching in the middle of the main tooth; remaining spines as follows: three on the anterior margin (basal: 0.3 mm; middle: 0.35 mm; apical: 0.4 mm) and two on the posterior margin (basal: 0.08 mm; apical: 0.3 mm). Nine setae directed at the base of the maxilla have the following lengths (in mm) from near the last spine to the base: 0.3, 0.3, 0.3, 0.35, 0.35, 0.4, 0.4, 0.4, 0.4. Maxillary palp (1.4 mm length) setose and conic, with setae of about 0.4 mm in length.

Table III  
Labium dimensions (in mm)

| Instar | Labial palp   |                |                       |                     | Prementum                |              |                 |            |              |
|--------|---------------|----------------|-----------------------|---------------------|--------------------------|--------------|-----------------|------------|--------------|
|        | Lateral setae | Internal setae | Internal crenulations | Distal crenulations | Width                    | Length       | Ligula (height) | Setae      | Movable      |
| F      | 7-8           | 8-9-10-11      | 7-8-9                 | 8-9                 | $\bar{X}$ 5.28<br>S 0.17 | 3.72<br>0.12 | 0.10<br>—       | 13-15<br>— | 0.72<br>0.04 |
| F-1    | 8             | 9              | 9                     | 9                   | 3.30                     | 3.30         | 0.10            | 11         | 0.50         |
| F-2    | 8             | 9              | 8-9                   | 8                   | 1.90                     | 2.10         | 0.01            | 11-9       | 0.40         |
| F-3    | 7             | 7              | *                     | 9-8                 | 1.70                     | 1.53         | —               | 10-11      | 0.30         |
| F-4    | 7             | 6              | *                     | 9-8                 | 1.70                     | 1.55         | —               | 10-12      | 0.30         |
| F-5    | 7             | 6              | *                     | 8                   | 1.50                     | 1.30         | —               | 10         | 0.20         |
| F-6    | 5-6           | 4              | *                     | 8                   | 1.10                     | 0.90         | —               | 8          | 0.17         |
| F-7    | 4             | 1-2            | *                     | 8                   | 0.80                     | 0.70         | —               | 6-7        | 0.12         |
| F-8    | 2             | —              | *                     | 7                   | 0.56                     | 0.40         | —               | 2-3        | 0.08         |
| F-9    | 2             | —              | *                     | 5                   | 0.40                     | 0.28         | —               | 2-4        | 0.08         |

\* Indefinite

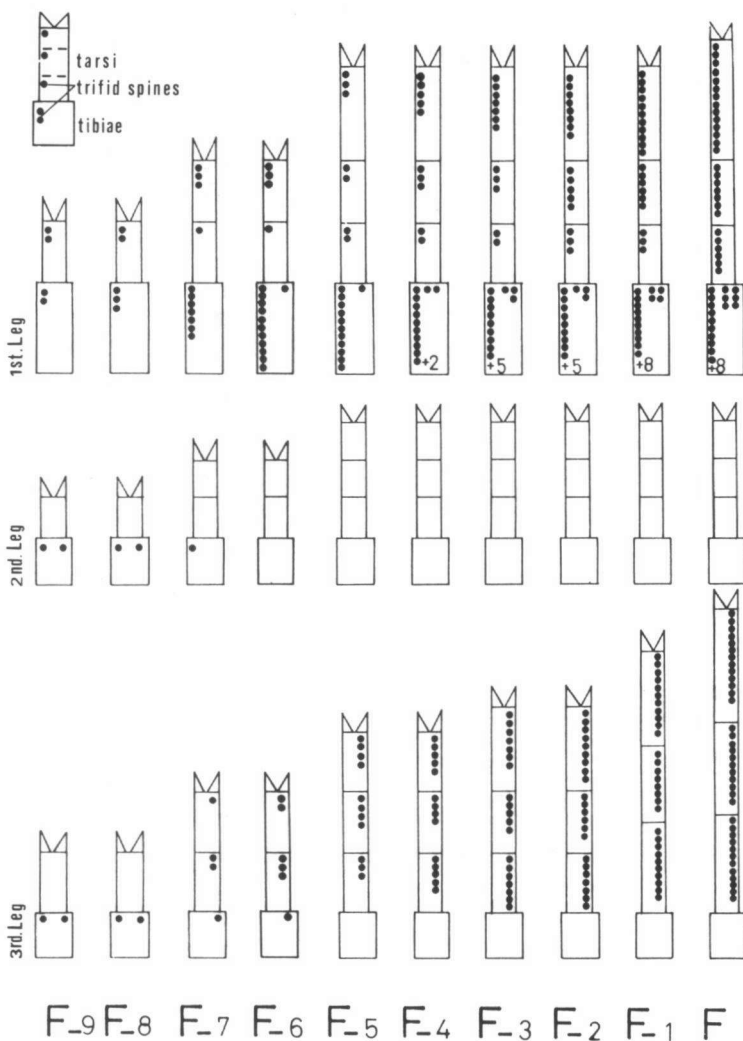


Fig. 2. *Orthemis nodiplaya*: left leg trifid setae pattern of each instar, ventral view.

Mandibular formula (according to WATSON, 1956) and Figures 5-6:

| L | 1 | 2 | 2'  | 3 | 4 | 0 | a | b |
|---|---|---|-----|---|---|---|---|---|
| R | 1 | 2 | 3+4 | x | y | a | b | d |

- Left
- A. 1.  $b > a$ .
  2. b is heavy and blunt, with a broad base; a is pointed.
  - B. 1. 2 is sharper than 1; 3 and 4 rounded.
  2.  $3 > 4 > 2 > 1$ .
  3. Incisors of left mandible are more prominent than right ones.

4. 1 is the most differentiated; bases of 3 and 4 fused. In inner view base of 3 wider than base of 4.
5. 2' is on the anterior margin of 2, small, somewhat sharp, smaller than 1 (in some cases very rounded and hardly seen).

Table IV  
Leg dimensions (in mm)

| Instar | Femora           | Tibia | Tarsus |      |      | Claw |
|--------|------------------|-------|--------|------|------|------|
|        |                  |       | 1st    | 2nd  | 3rd  |      |
| F      | Fore legs        |       |        |      |      |      |
|        | $\bar{X}$ : 3.40 | 3.88  | 0.54   | 0.54 | 0.85 | 0.50 |
|        | S: 0.12          | 0.08  | 0.05   | 0.03 | 0.05 | —    |
| F-1    | 2.70             | 2.90  | 0.40   | 0.40 | 0.65 | —    |
| F-2    | 2.10             | 2.10  | 0.30   | 0.30 | 0.50 | —    |
| F-3    | 1.60             | 1.80  | 0.20   | 0.22 | 0.43 | —    |
| F-4    | 1.45             | 1.55  | 0.20   | 0.15 | 0.30 | —    |
| F-5    | 1.20             | 1.40  | 0.20   | 0.18 | 0.20 | —    |
| F-6    | 0.95             | 0.90  | 0.10   | 0.25 | —    | —    |
| F-7    | 0.75             | 0.78  | 0.10   | 0.23 | —    | —    |
| F-8    | 0.37             | 0.44  | 0.22   | —    | —    | —    |
| F-9    | 0.34             | 0.36  | 0.20   | —    | —    | —    |
| F      | Mid legs         |       |        |      |      |      |
|        | $\bar{X}$ : 3.64 | 4.03  | 0.59   | 0.50 | 0.99 | 0.54 |
|        | S: 0.07          | 0.14  | 0.03   | —    | 0.08 | 0.05 |
| F-1    | 2.80             | 2.90  | 0.40   | 0.40 | 0.65 | —    |
| F-2    | 1.90             | 2.20  | 0.30   | 0.20 | 0.55 | —    |
| F-3    | 1.65             | 1.80  | 0.25   | 0.20 | 0.40 | —    |
| F-4    | 1.50             | 1.70  | 0.22   | 0.18 | 0.35 | —    |
| F-5    | 1.30             | 1.50  | 0.20   | 0.18 | 0.30 | —    |
| F-6    | 1.10             | 0.10  | 0.15   | 0.30 | —    | —    |
| F-7    | 1.01             | 0.89  | 0.13   | 0.27 | —    | —    |
| F-8    | 0.47             | 0.45  | 0.27   | —    | —    | —    |
| F-9    | 0.37             | 0.40  | 0.22   | —    | —    | —    |
| F      | Hind legs        |       |        |      |      |      |
|        | $\bar{X}$ : 4.69 | 5.63  | 1.10   | 1.15 | 1.44 | 1.08 |
|        | S: 0.06          | 0.14  | —      | 0.11 | 0.05 | 0.05 |
| F-1    | 3.30             | 4.20  | 0.80   | 0.80 | 1.30 | —    |
| F-2    | 2.50             | 2.90  | 0.60   | 0.50 | 0.80 | —    |
| F-3    | 2.02             | 2.60  | 0.50   | 0.40 | 0.75 | —    |
| F-4    | 1.94             | 2.30  | 0.40   | 0.35 | 0.60 | —    |
| F-5    | 1.60             | 1.90  | 0.35   | 0.30 | 0.50 | —    |
| F-6    | 1.40             | 1.50  | 0.25   | 0.65 | —    | —    |
| F-7    | 0.98             | 1.10  | 0.46   | 0.11 | —    | —    |
| F-8    | 0.56             | 0.63  | 0.37   | —    | —    | —    |
| F-9    | 0.51             | 0.47  | 0.32   | —    | —    | —    |

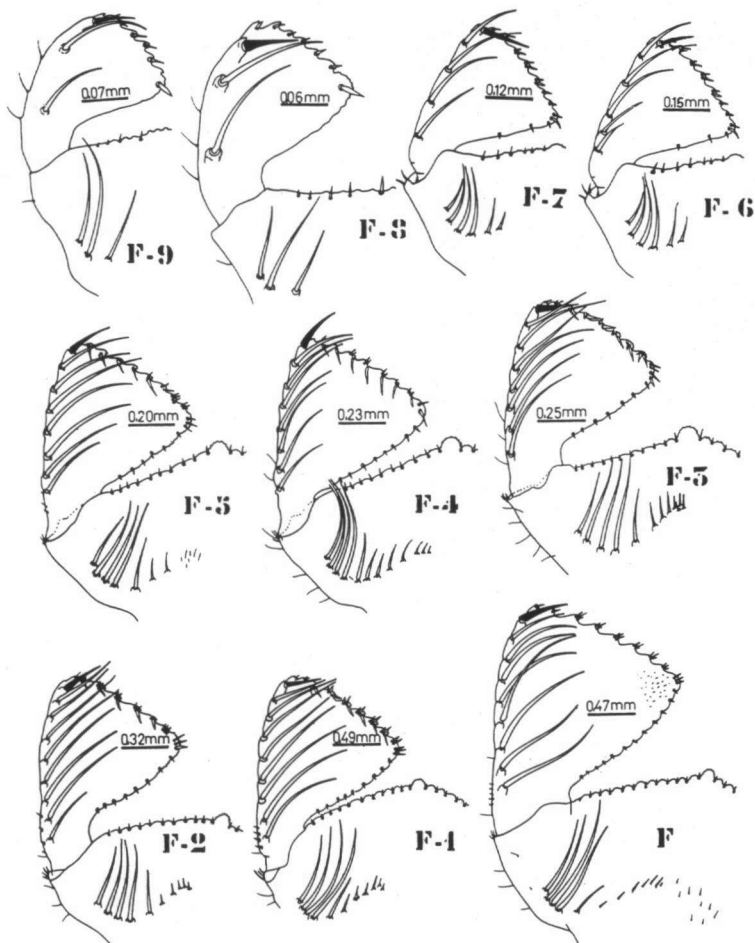


Fig. 3. *Orthemis nodiplaga*: labial setae pattern of each instar.

Right A. 1.  $b > d > a$ .

2. Molars are heavy with broad bases, all pointed.

B. 1. 1 and 2 slightly sharpened; 3+4 heavy and rounded.

3. Incisors less distinct than on the left.

4. The base of 1 is the widest.

C. 1. y is very small.

3. x scarcely seen as a little protuberance on the base of 1.

Thorax. — Ventral surface, wing pads, coxae and trochanters green; femora and tibiae brown. Fore wing pads:  $7.01 \text{ mm} \pm 0.24$  in length, reaching posterior margin of 6th tergite, pleura with abundant pilosity.



Table VI  
Middorsal length and length of lateral  
spines on segments 8-9 (in mm)

| Segment | Middorsal<br>length | Lateral<br>spine length |
|---------|---------------------|-------------------------|
| 8th     | $\bar{X}$ : 0.79    | 0.44                    |
|         | S: 0.08             | 0.05                    |
| 9th     | $\bar{X}$ : 0.67    | 0.07                    |
|         | S: 0.36             | 0.05                    |

Abdomen. — Dorsal and ventral surface of segments 1-6 green; 7-10 and caudal appendages brown. Tergites 4-9 latero-centrally marked with pale punctations. Maximum length: 11.8 mm; maximum width: 7.6 mm, width/length ratio: 0.64. Caudal appendages, epiproct: 2.95 mm, paraprocts: 3.00 mm, cerci: 0.80 mm. For lengths of lateral spines on 8th and 9th tergites see Table VI.

DISCUSSION

The last larval instar of *O. nodiplaga* can be distinguished from that of *O. ferruginea* by a non-cylindrical body, the wider abdomen and the more developed lateral spines of segments 8 and 9. In addition, the abdominal coloration differs from GEIJSKES' (1935) description of *O. ferruginea* in that the last mentioned species presents a diffuse stripe on segments 1-5, as well as a darker stripe on each

Table VII  
Comparison between *Orthemis ferruginea* and *O. nodiplaga* larvae

| Character               | <i>ferruginea</i> |                  |                  |                             | <i>nodiplaga</i>                            |
|-------------------------|-------------------|------------------|------------------|-----------------------------|---------------------------------------------|
|                         | NEEDHAM<br>1904   | CALVERT<br>1927  | GEIJSKES<br>1935 | NEEDHAM &<br>WESTFALL, 1954 |                                             |
| Body length             | 22.0              | 21-25.5          | 20-23.5          | 20-23                       | 19.5-20.4                                   |
| Head width              | 5.5               | 4.8-5.1          | 4.5-4.7          | —                           | 4.8                                         |
| Length of<br>abdomen    | 7.0               | —                | —                | —                           | 7.4                                         |
| 8th lateral<br>spine*   | 25%               | 0.3              | 0.3              | 50%                         | 55.7 (0.4)                                  |
| 9th lateral<br>spine*   | 25%               | 0.3              | 0.3              | 60%                         | 53.7 (4.7)                                  |
| Length of<br>femora III | 5.5               | 4.9-5.5          | 4.7              | —                           | 4.7                                         |
| Labial palp             | 8                 | 9                |                  |                             |                                             |
| Lateral setae           |                   | (8-9-10)         | 9                | 9                           | 7-8                                         |
|                         |                   | WATSON, 1956     |                  |                             |                                             |
| Right mandible          |                   | 3 and 4 distinct |                  |                             | 3 and 4 less<br>distinct                    |
|                         |                   | d > b            |                  |                             | b > d                                       |
| Left mandible           |                   | b pointed        |                  |                             | b is heavy and<br>blunt, with<br>broad base |

\* Length in mm (in brackets: % of middorsal length of respective segment)

side on the segments 6-10, while *O. nodiplaga* shows latero-centrally pale punctuations on segments 4-9.

Table VII shows the meristic differences between these species.

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