Description of the Mature Larva of *Nemka viduata* (Pallas) (Hymenoptera: Multillidae: Mutillinae), a Parasitoid of *Stizus continuus* (Klug) (Hymenoptera: Crabronidae: Bembicinae)[1]

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Abstract The mature larva of *Nemka viduata* (Pallas) is described and illustrated. Morphological structures of phylogenetic value are discussed. The mature larva of this species is recognized by the followings traits: (a) head with parietal bands, (b) frontoclypeal suture distinct, and (c) labium with eight apical setae and two apical papillae. After further investigation, the presence of two apical papillae on the labium may represent an autapomorphy for the genus *Nemka* Lelej.

Key Words Smicromyrmini, velvet ant

Few studies have addressed the preimaginal stages of the Mutillidae. Of the approximately 9000 species of Mutillidae (Pitts and Matthews 2000), only the mature larvae of seven species or subspecies, belonging to six genera, have been described: *Smicromyrme rufipes* (F., 1787) (Grandi 1961), *Pseudomethoca frigida* (Smith 1855) (Brothers 1972), *Myrmosula parvula* (Fox 1893) (Brothers 1978), *Dasymutilla chiron ursula* (Cresson 1875) (Evans 1987), *Dasymutilla scaevola* (Blake 1871) (Hook and Evans 1991), *Sphaeropthalma pensylvanica* (Lepeletier 1845) (Pitts and Matthews 2000) and *Odontophotopsis succinea* Viereck, 1903 (Pitts and Parker 2003). The descriptions of the mature larvae of other species reported by Lloyd (1916), Crèvecoeur (1930), Maréchal (1930), Janvier (1933), Seyrig (1936), and Clausen (1940) are succinct and in some cases inadequate and, therefore, cannot be used for comparative purposes.

Here we describe the mature larva of *Nemka viduata* (Pallas 1773) (Mutillinae: Smicromyrmini). This species is a parasitoid of ground-nesting aculeate Hymenoptera. The mature larva of this species is the eighth known for the family Mutillidae and the first to be described for this genus.

Materials and Methods

Larvae of *N. viduata* were obtained from nests of *Stizus continuus* (Klug 1835) (Hymenoptera: Apiodea: Crabronidae: Bembicinae, *sensu* Melo 1999), that were established in an area of compact sandy soil in the natural reserve "La Dehesa del Saler" (El Saler, Valencia, Spain). Several nests of the host were excavated in August

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2001 and were found to contain cocoons of *S. continuus,* six of which contained in their interior a fragile silken cocoon with a mature larva of *N. viduata.* The larvae were fixed and preserved in 70% ETOH. The method employed to prepare the larval specimens as well as the terminology of larval morphology and format used in the descriptions follow those of Evans (1987). The following abbreviations have been used in the descriptions: d = diameter; h = height; l = length, n = number, w = width, and x = mean. The classification of Mutillidae follows Brothers (1975, 1999). Voucher specimens are deposited at the "Torres-Sala" Entomological Foundation (Valencia, Spain).

Results

Nemka viduata (Pallas)

Mature larva. General aspect (Fig. 1). Body (l = 15.3 mm, maximum w = 4.7 mm) hymenopteriform, robust, elongate, slightly curved, with 3 thoracic and 10 abdominal segments, yellowish white, weakly sclerotized, except for spiracles and setae. Anal segment rounded, not produced above the anus; anus terminal, slit-like. Pleural lobes present on first 8 abdominal segments, rounded. Integument spinulose (l of spinules = 15 µm), with scattered setae (l = 20-35 µm); spinules less abundant and smaller on ventral region; last abdominal segments without spinules, with disperse setae. Spiracles (Fig. 1) on prothorax-mesothorax, metathorax, and first 8 abdominal segments; pair on metathorax (d = 35 µm) minute, without differentiated subatrium and apparently non-functional, without visible connection with tracheal trunks; other spiracles (Fig. 2) with the atrium (d = 110-125 µm, x = 118 µm, n = 18) goblet-shaped, lined with

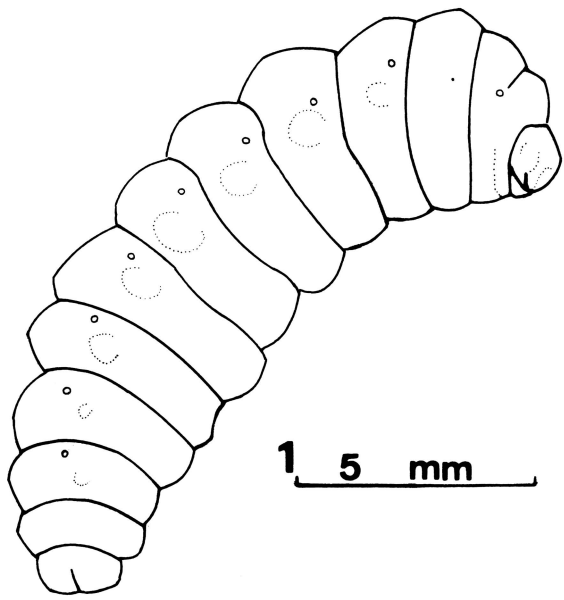

Fig. 1. Mature larva of *Nemka viduata* (Pallas): General aspect.

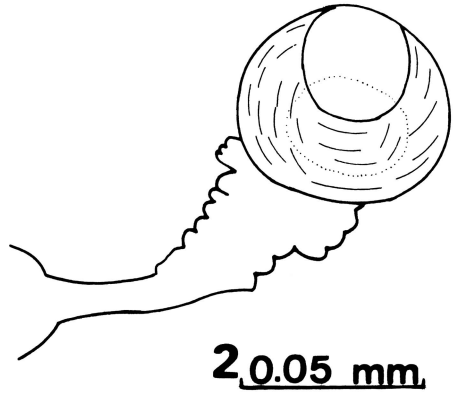

Fig. 2. Mature larva of *Nemka viduata* (Pallas): Abdominal spiracle.

weak ridges; opening into subatrium large and unarmed; subatrium long and expanded (d = 75 µm), with 6-8 swellings.

Cranium (Fig. 3) [w = 1.39 mm, h (height measured to apex of clypeus) = 1.15 mm] 1.2× as wide as high, unpigmented except for: the parietal bands, antennae, the apical halves of mandibles, mandibular articulations, maxillary and labial palpi, galeae, and salivary orifice; with sparse setae (l = 20 µm) as figured; sides of head more convex than vertex; vertex not depressed medially; coronal suture absent; parietal bands present; antennal orbits (d = 110 µm) on mammiform elevations, located below middle of head, circular; central papilla (d = 32.5 µm) with 3 sensilla (d = 7.5 µm) at center; frontoclypeal suture not defined; clypeolabral suture well below mandibular articulations. Clypeus with punctures, partly setigerous. Labrum (Fig. 4a) (maximum w = 440 µm; median h = 185 µm) bilobate; anterior margin spinulose; each lobe surface with 8 punctures, 10 setae (l = 9 µm) and 5 apical conical sensilla (d = 5 µm, l = 7 µm); epipharynx (Fig. 4b) spinulose (l of spinules = 2 µm) apically and laterally, with 14 sensory pores (d = 5 µm) medially distributed.

Mouthparts. Mandibles (l = 410 µm, w = 230 µm) robust, sclerotized, about 1.7× as long as wide at base, without setae or roughened areas, with 4 apical teeth in about the same plane, the basal-most tooth smaller, 3 apical teeth subequal in size. Maxillae (Fig. 5) with 6 lateral setae (l = 25 µm), mesally with spinules (l = 2-3 µm) similar to those on epipharynx; maxillary palpi (Fig. 6) wider than high (61 × 48 µm) with 4 apical sensilla (d = 10 µm); galeae (w = 20 µm, h = 16 µm) smaller than palpi but similarly formed, with 2 apical sensilla (d = 10 µm). Labium (Fig. 7) (w = 400 µm) broad, with 8 small apical setae (l = 18 µm) and 2 apical papillae; smooth oral surface; labial palpi (38 × 20 µm) oval, much broader than high, with 4 sensilla (d = 7.5 µm); salivary orifice (w = 165 µm) transverse, more or less ovoid, widened medially.

Discussion

The few species of Mutillidae for which the mature larva has been described do not permit reliable establishment of the apomorphies of the subfamilies, tribes, genera, or species. Nevertheless, the description of *N. viduata* reasonably agrees with the de-

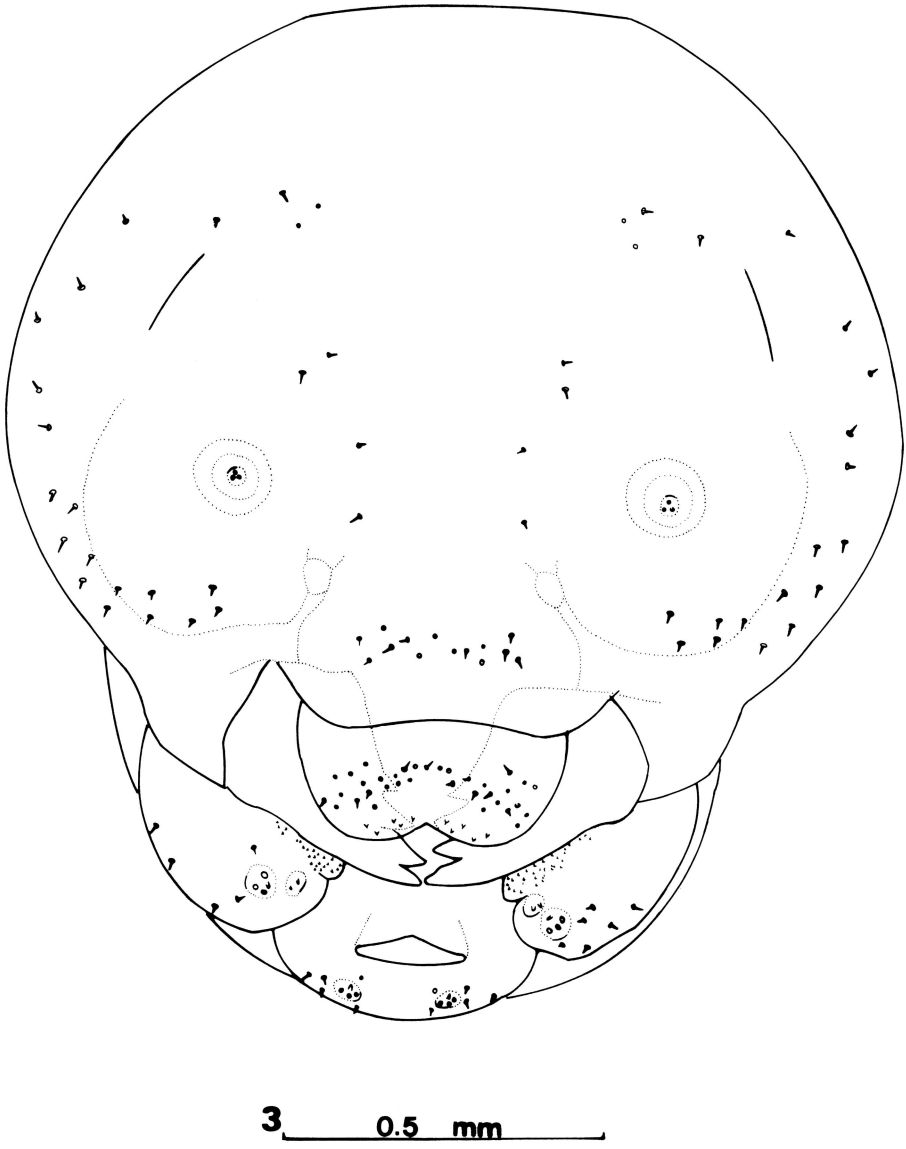

Fig. 3. Mature larva of *Nemka viduata* (Pallas): Cranium.

scription of the mature larva of the Mutillidae given by Evans (1987). Differences between the other species described are probably characters at the subfamiliar, tribal, generic, or specific level (Table 1).

The mature larva of *N. viduata* shares the following character states with other species of Mutillidae: (a) integument with spinules; although Grandi (1961) fails to

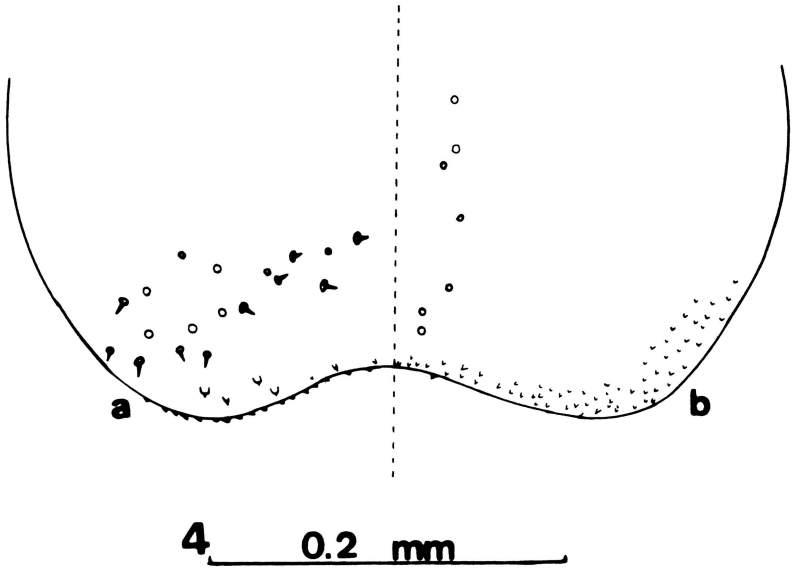

Fig. 4. Mature larva of *Nemka viduata* (Pallas): (a) Labrum. (b) Epipharynx.

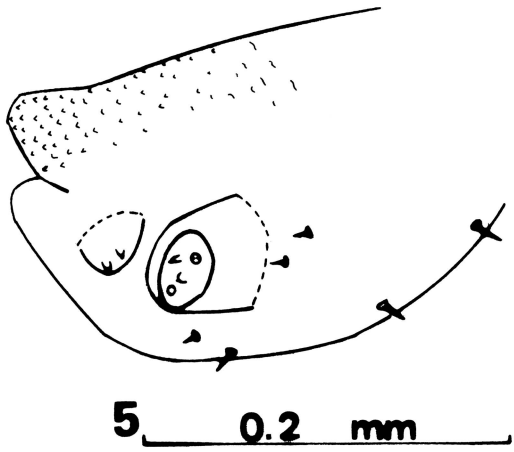

Fig. 5. Mature larva of *Nemka viduata* (Pallas): Maxilla.

mention the tegumental differentiations of the body for *S. rufipes;* (b) ten pairs of spiracles present, with the second pair being much smaller than the others and apparently non-functional; (c) sides of the head more convex than vertex; (d) labrum emarginate (bilobate), with margin spinulose; (e) epipharynx spinulose, with sensory pores towards the midline; (f) mandibles quadridentate without setae or irregularities

Fig. 6. Mature larva of *Nemka viduata* (Pallas): Maxillary palpus.

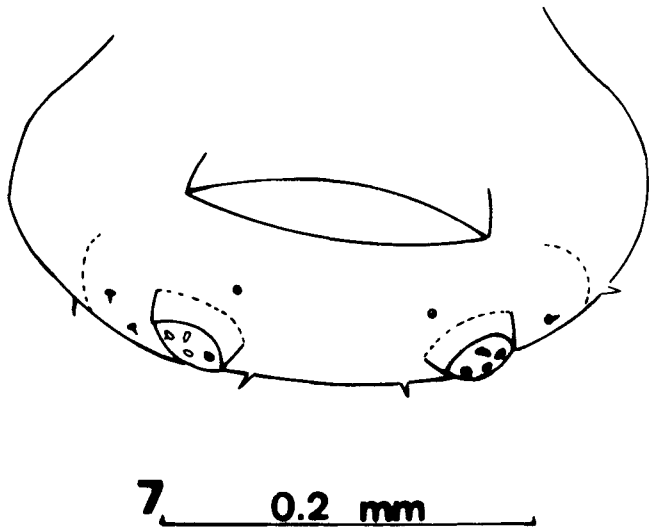

Fig. 7. Mature larva of *Nemka viduata* (Pallas): Labium.

(although Janvier (1933) reports that two Chilean species: *Dimorphomutilla lunulata* (Spinola 1851) and *Neomutilla attenuata* (Spinola 1851), have tridentate mandibles); (g) maxillae with a few lateral setae and mesal margin spinulose; (h) maxillary palpi wider than high, and (i) galeae wider than long, with two apical sensilla.

However, the following character states are only shared by some of the mature larvae described and may, therefore, be important at the subfamiliar, tribal, generic or specific level (Table 1): (a) integument: with setae (Mutillinae + Myrmosinae + *Pseudomethoca* Ashmead + *D. scaevola*)/without setae (*Sphaeropthalma* Blake + *Odontophotopsis* Viereck + *D. chiron*); (b) anal segment: rounded above and below the transverse anal slit (Mutillinae (a character not addressed by Grandi (1961) in his description of *S. rufipes*) + *Sphaeropthalma* + *Pseudomethoca* + *D. scaevola*)/ abdominal segment elongate conically, produced above the anus (Myrmosinae + *D.*

Table 1. Characters of mature larvae or prepupae of Mutillidae. Integument: (1): with setae (A), without setae (B). Abdomen: (2) anal segment rounded above and below the transverse anal slit (A), abdominal segment elongate conically, produced above the anus (B). Spiracles: (3): with atrium lined with ridges (A), unarmed (B); (4) subatrium elongate (A), no differentiated subatrium (B). Head: parietal bands (5): present (A), absent (B); antennal orbits (6): located below middle of head (A), located on middle, or above middle, of head (B); frontoclypeal suture (7): distinct (A), indistinct (B), Mandibles: (8): with basal tooth smallest (A), with four apical teeth of about equal size (B). Maxillae: maxillary palpi (9): with four apical sensilla (A), with three apical sensilla (B). Labium: (10): with eight apical setae (A), with a greater number of apical setae (B); (11): with two apical papillae (A), without apical papillae (B)

Characters	Taxa							
	Mutillinae		Myrmosinae	Sphaeropthalminae				
	Smicromyrmini			Sphaeropthalmini				
	Nemka	*Smicromyrme*	*Myrmosula*	*Dasymutilla*		*Pseudomethoca*	*Sphaeropthalma*	*Odontophotopsis*
	N. viduata	*S. rufipes*	*M. parvula*	*D. scaevola/chiron*		*P. frigida*	*S. pensylvanica*	*O. succinea*
1	A	?	A	A	B	A	B	B
2	A	?	B	A	B	A	A	?
3	A	?	A	B	A	A	B	B
4	A	?	B	A		A	A	A
5	A	B	B	A		B	A	A
6	A	A	B	A		A	A	A
7	B	A	A	B	A	A	A	?
8	A	A	B	A		A	A	A
9	A	A	A	B	A	A	A	B
10	A	B	B	B		B	A	?
11	A	B	B	B		B	B	B

chiron); (c) spiracles: with atrium lined with ridges (Mutillinae (a character not mentioned by Grandi (1961) for *S. rufipes*) + Myrmosinae + *D. chiron* + *Pseudomethoca*)/unarmed (*Sphaeropthalma* + *Odontophotopsis* + *D. scaevola*); (d) subatrium: elongate (Mutillinae (character not mentioned by Grandi (1961) for *S. rufipes*) + Sphaeropthalminae)/not differentiated (Myrmosinae); (e) parietal bands: present (*Sphaeropthalma* + *Odontophotopsis* + *Nemka* Lelej + *Dasymutilla* Ashmead)/absent (Myrmosinae + *Simicromyrme* Thomson + *Pseudomethoca*); (f) antennal orbits: located below middle of head (Mutillinae + Sphaeropthalminae)/located on middle, or above the middle, of the head (Myrmosinae); (g) frontoclypeal suture: distinct (Myrmosinae + *Sphaeropthalma* + *Pseudomethoca* + *D. chiron* + *Smicromyrme*)/indistinct (*N. viduata* + *D. scaevola*); (h) mandible: with basal tooth smallest (Mutillinae + Sphaeropthalminae)/with four apical teeth of about equal size (Myrmosinae); (i) maxillary palpi: with four apical sensilla (Mutillinae + Myrmosinae + *Sphaeropthalma* + *Pseudomethoca* + *D. chiron*)/with three apical sensilla (*D. Scaevola* + *Odontophotopsis*); (j) labium: with eight apical setae (*Nemka* + *Sphaeropthalma*)/with a greater number of apical setae (Myrmosinae + *Smicromyrme* + *Dasymutilla* + *Pseudomethoca*), and (k) labium: with two apical papillae (*Nemka*) without apical papillae (*Smicromyrme* + Myrmosinae + Sphaeropthalminae).

Unlike the other described species of Smicromyrmini (*S. rufipes*), *N. viduata* exhibits the followings traits: (a) head with parietal bands; (b) frontoclypeal suture indistinct and (c) labium with eight apical setae, and two apical papillae. Mature larvae of *Nemka* would be characterized by displaying two apical papillae on labium.

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