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Sonderdruck aus
Beiträge zur Neotropischen Fauna
Band VI, Heft 2, 1969
Gustav Fischer Verlag · Stuttgart

With compliments from

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Caenis cuniana sp. n., a Parthenogenetic Mayfly

Von

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With 1 Figure

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In the course of faunistic studies on the stoneflies and mayflies of the State of São Paulo, Brazil, I noticed a species of *Caenis*, the description of which follows, to be parthenogenetic. A series of nymphs collected in the field yielded only females: from these, several generations of females were obtained in the Laboratory in the course of almost one year. This indicates that this species presents thelytoke parthenogenesis. For detailed information on parthenogenesis and other aspects of reproduction in mayflies, the outstanding paper of DEGRANGE (1960) should be consulted.

Family Caenidae

Genus *Caenis* Stephens

Caenis cuniana sp. n.

Caenis sp. DEMOULIN, 1955, Bull. Inst. roy. Sci. nat. Belg. 31 (20): 4-5, figs. 2-3.

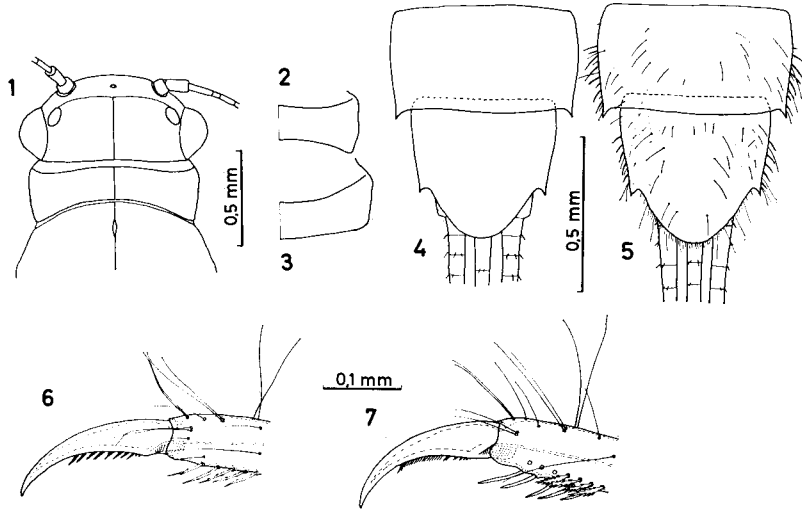
Description

Adult, female (alcoholic material, fresh). General colour of dorsal side light to medium brown. Head ochraceous, darker at epicranial suture and along a line from median to paired ocelli; vertex and occiput also darker. Base of ocelli and scape of antennae dark brown. Pronotum short, darker medially and at borders. Mesonotum ochraceous to brown, dark along suture and frequently along a medio-lateral line on each side. Scutellum slightly darker. Abdominal terga brownish, sometimes with a violet tinge on segments I-VIII; lateral margins clear except for dark stigmatic spots. Tails whitish, basal segments very light brown. Ventral surface whitish. Prosternum narrow, fore coxae approximated. Posterior margin of last abdominal segments produced laterally into small spines.

Wings clear, larger veins especially Sc and R-R₁ brownish, 2-3 subcostal cross-veins near radial cross-vein. Fore legs slightly darker than second and third pairs. Femora with a dark patch about middle and another at apex. Distal half of tibiae darker.

Subimago, female. Similar to adult, but colour less shining and wings clouded. Posterior margin of last abdominal segments produced laterally into small spines.

Nymph, full-grown (Figs. 1-7; cf. also Demoulin, 1955, Figs. 2 and 3). Head, thorax and gill covers brown with some mottling; abdomen ochraceous with darker markings, especially at margins. Ventral cuticle transparent. Antennae light brown, scape and pedicel darker. Femora with dark markings towards middle and a preapical dark band; tibiae and tarsi each with a dark band across middle. Tails light brown.



Caenis cuniana sp. n.

Fig. 1. Outline of head and prothorax, full-grown nymph, dorsal aspect. Fig. 2. Pronotum, right half, exuvia of last nymphal instar. Fig. 3. The same, from a flattened specimen. Fig. 4. 9th and 10th abdominal sternites, full-grown nymph, hairs and bristles not drawn. Fig. 5. 9th and 10th sternites, full-grown nymph, larger hairs and bristles shown. Fig. 6. Claw of 2nd leg, full-grown nymph. Fig. 7. Claw of 3rd leg, full-grown nymph.

Mouth parts as shown by DEMOULIN, l. c., Fig. 3 a-f. Apical canine of right mandible with 2-3 teeth, basal one with 2; those of left mandible with 3-4 (usually 4) and 2-3 (usually 3) teeth respectively. Third segment of labial palpi more than half as long as second.

Pronotum (Figs. 1-3) with sides almost straight, diverging slightly forwards; corners rounded. Claws of first and second pairs of legs (Fig. 6) with 6-12 (mostly 9-11) spinules, the basal ones minute. Claws of third legs (Fig. 7) with 3-6 basal minute spinules followed by a row of setules ending by a bifid or multifid spinule. Gill covers (cf. DEMOULIN, l. c., Fig. 3 g) with a row of long hairs along mesial ridge and some scattered ones along lateral ridge and elsewhere. Marginal fringe of simple hairs; submarginal row of short frilled bristles present. Posterior margin of tenth abdominal sternite rounded (Figs. 4 and 5). Tails subequal, median filament frequently slightly longer.

Table 1
Time required from oviposition to hatching of eggs of *Caenis cuniana*

Date of oviposition	Number of eggs	Temperature	Days after oviposition, with number of nymphs hatched																	Total hatched					
			8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25		29				
22/3/67	224 (2 ♀♀)	25.5° C	62	98	0	5	5	1	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	179	
22/3/67	ca. 600 (2 ♀♀)	25.5° C	3	57	45	44	240	0	18	1	10	0	0	0	0	0	0	0	0	0	0	0	6	1	434
13/4/67	330	23.5° C	0	0	7	252	21	32	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	323
13/4/67	342	23.5° C	0	—	44	276	9	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	340
31/5/67	390	21° C	0	0	0	0	0	0	9	13	60	—	95	167	0	21	6	2	0	0	0	0	0	0	373

Numerical Data

1. Adults. Holotype female: length of body, 2.6 mm; of wings, 2.3 mm; of antennae, 0.55 mm; of tails, 1.8 mm. Other females: length of body, 2.5–3.8 mm; of wings, 2.2–2.9 mm; of antennae, ca. 0.6 mm; of tails, 1.8–2.5 mm.

2. Nymphs. Exuvia of holotype: length of body, 3.8 mm; of antennae, 3.4 mm (38 segments), of tails, 5.0 mm (ca. 100 segments). Other full-grown nymphs or respective exuviae: length of body, 3.8–4.8 mm; of antennae, 2.5–3.8 mm (29–38 segments); of tails, 5.0–6.5 mm (87–118 segments). First instar nymphs: length of body, 0.35–0.43 mm; of antennae, 0.18–0.23 mm (5 segments); of tails, 0.28–0.38 mm (5 segments).

Material

Holotype: Female imago, kept with its nymphal exuvia, reared and emerged in the laboratory 28th March, 1967 from material collected at the Estação Biológica de Boracéia, State of São Paulo, Brazil, in September 1966. Deposited in the Department of Zoology, Faculty of Philosophy, University of São Paulo, Brazil.

Paratypes: 10 imagos, 10 subimagos und respective nymphal exuviae, reared and emerged in the laboratory March–July 1967, from material collected at the Estação Biológica de Boracéia in September, 1966. Department of Zoology, Faculty of Philosophy, University of São Paulo.

Further material. Estação Biológica de Boracéia: ca. 300 subimagos and adults, emerged in the laboratory, September 1966–August 1967, plus numerous nymphs in various stages of development either collected at the E. B. B. or reared in the laboratory.

Represa Guarapiranga (Guarapiranga Dam) at Jardim Santa Helena, São Paulo; Giovanni Strixino, Sergio Teixeira da Silva and Alessio Padula coll. 19th August, 1966: 76 subimagos and adults emerged in the laboratory, August 1966–June 1967, plus nymphs, as above.

Cidade Universitária, São Paulo – “Raia Olímpica” (Campus of the University of São Paulo): 1 full-grown nymph, preemergent, 11th March, 1966.

Remarks

The nymphs DEMOULIN (1955) had from Alto da Serra (the town of Alto da Serra, on the railway from São Paulo to Santos, is now called Paranapiacaba; nearby is located a Biological Station, visited by the MISSION MASSART, on which material DEMOULIN's paper is based) belong undoubtedly to the present species. It may be that part of the material TRAVER (1944) had from the States of São Paulo and Minas Gerais belongs also to *Caenis cuniana*. *Caenis* sp. TRAVER, 1944, from Rio Grande do Sul has more cross-veins on the wings and a different colour pattern with, e. g., a black band between the eyes and 3 blackish marks on the femora.

Males being absent, the generic position must be based on the nymphs. As these have gill covers with a row of submarginal spines but no large spines on the mesial fork, and a broadly emarginate labrum, I think the species should remain in *Caenis* despite the toothed claws (cf. THEW, 1960).

The Life History

Oviposition and Eggs. Soon after the imaginal moult, females are ready for oviposition, what they do on contact with water. The eggs are expelled in masses, which break up immediately on reaching the water, the eggs falling separately to the bottom. During oviposition the female darts about the surface, due to a lowering of the surface tension at the genital openings. In the process, there occurs normally rupture of the intersegmental membrane between sterna VII and VIII and at the end a portion of the air-filled intestine usually protrudes. The number of eggs laid by each female lies usually between 100 and 300. The minimum was 31 eggs, the maximum, 390 eggs.

The eggs are oval, about 130 by 105 μ , and light brown when laid. They have attachment threads either at one or at both poles; the threads, as in other species of *Caenis*, being wound up in a close spiral when laid and uncoiling subsequently in the water. The chorion is smooth, rather transparent, allowing the embryo to be seen. In the laboratory, the time required from oviposition to hatching of the egg varied from 7 to 29 days. Hatching of eggs from a single oviposition did not take place at once, but in the course of several days, as shown in Table I. The temperature column gives the approximate mean temperature during the time of development of the eggs.

Nymphs. First instar nymphs are ca. 0.40 mm long, and the antennae, cerci and median filament have all 5 segments. Second instar nymphs are ca. 0.44 mm long, with antennae and tails 6-segmented. Third instar nymphs have grown to about 0.50 mm in length, the antennae have 7 segments and the tails ca. 10. In the next two instars the number of antennal segments increases to about 10 and that of the tails to ca. 20. Gills are generally absent in the first three instars, but the instar in which they appear was not observed. It was not possible to follow the growth of individual nymphs and to determine the number of nymphal instars. Assuming DYAR's rule to be valid in their development, a series of measurements (length of body, of tibia plus tarsus of hind leg, and of claw of the same leg) of young nymphs as compared with those of grown ones, indicate there are 15 or 16 nymphal instars. 126 nymphs were reared to maturity under controlled conditions. The shortest time required for development, from oviposition to emergence, was 50 days, the longest one, 84 days, the average being 71 days. The period of emergence from a single oviposition extended from 20 to 30 days.

Emergence. Mature nymphs climb or float to the surface. They float naturally, for air occurs between the old nymphal cuticle and the subimago. The emergence is rapid, the wings expand instantaneously and the subimago takes flight at once, falling commonly back onto the surface film. They may take flight again or, if the wings are wetted, be doomed. On finding a firm substrate, the imaginal moult takes place, usually 4-7 minutes after emergence and taking about 15 seconds to complete. Emergence usually occurs late in the afternoon or soon after nightfall. If they do not oviposit, the adults are active for about two hours, after which they become sluggish and die. In the laboratory adults appeared all the year round, and the same should occur also in nature.

Ecological Notes. On the whole, the nymphs of this species are similar, as regards habitats and habits, to those of *Caenis diminuta*, as described by BERNER (1950). They are found in the shallow parts of ponds and dams, especially where there is rooted vegetation. They are found also in shallow marshes, where the temperature fluctuates widely. They sometimes climb up the water plants, including *Nitella*, if present (cf. Traver, 1944, p. 27). The adults, as is the rule for *Caenis*, are attracted to light.

Acknowledgements

The Fundação de Amparo à Pesquisa do Estado de São Paulo (State Foundation for the Support of Research) contributed with financial help for my studies. Dr. PAULO E. VANZOLINI, Director of the Department of Zoology of the State Bureau for Agriculture, has kindly permitted me to collect at the Biological Station of Boracéia.

Abstract

Caenis cumiana n. sp. is described. Females, soon after the imaginal moult, are ready for oviposition. The number of eggs laid varied usually between 100 and 300. The time required for hatching varied from 7 to 29 days; hatching of eggs from a single oviposition extended over several days. The nymphs required on an average 71 days from hatching to emergence. 4-7 minutes after emergence of the subimago the imaginal moult took place. The active life of adults lasted about 2 hours. Emergence took place all the year round. Nymphs live in shallow water, even in shallow marshes where the temperature fluctuates widely.

Resumo

Caenis cumiana n. sp. é descrita.

As fêmeas, logo após a muda imaginal, estão prontas para a ovipostura. O número de ovos variou entre 100 e 300 e o tempo necessário para a eclosão, de 7 a 29 dias. A eclosão de cada ovipostura estendeu-se por vários dias. Desde a eclosão até a emergência, as ninfas necessitaram, em média, de 71 dias. De 4 a 7 minutos após a emergência da subimago, dá-se a muda imaginal. A vida ativa dos adultos dura cerca de 2 horas. Os adultos apareceram durante o ano todo. As ninfas vivem em águas rasas, mesmo em brejos onde a temperatura da água flutua largamente.

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