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THE EGG-BURSTER OF THE FLATID PLANTHOPPER *METCALFA PRUINOSA* (SAY) (HOMOPTERA, FULGOROIDEA)*

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Abstract.—The egg-burster of *Metcalfa pruinosa* (Say), a nearctic flatid recently recorded from Italy, is described and illustrated by drawings, light stereomicroscope photographs and SEM micrographs. The egg-burster is located on the frontal region of the embryonic cuticle and is composed of two subparallel elongated blades with very sharp serrated edges. After hatching, the embryonic cuticle remains shriveled on the empty eggshell.

Key Words: Rhynchota, Auchenorrhyncha, Flatidae, embryonic cuticle, hatching

Hatching in insects is effected in various ways, as extensively summarized by Hinton (1981). The larva's escape from the egg is often facilitated by special structures called "egg-bursters." Formed of spines, teeth or blades, the egg-burster may appear on the hatching larva, as it does in most nematocerous Diptera, Siphonaptera and Coleoptera (Richards and Davies 1977), or it can be borne on the middle of the head of the embryonic cuticle, as in Ephemeroptera, Psocoptera, Mallophaga, and Neuroptera (Hinton 1981).

This embryonic cuticle (Wigglesworth 1939), also known as the "hatching membrane" (Snodgrass 1935), is a thin cuticular sheath enveloping the embryo. It occurs in most exopterygotes, in some endopterygotes, and in other arthropods such as Arachnida, Crustacea, Chilopoda and Diplopoda (Snodgrass 1935).

In this paper the egg-burster of *Metcalfa pruinosa* (Say) is described. This flatid planthopper of nearctic origin was recently accidentally introduced into Italy (Zangheri and Donadini 1980). The species is spread, to date, in North and Central Italy as far as Lazio and feeds on a wide variety of wild and cultivated plants (Duso and Pavan 1987).

This work seems to represent the first description of a flatid egg-burster in detail, even though Muir and Kershaw (1912) hinted at the presence of an egg-burster in the flatid *Siphanta acuta*. As concern other Fulgoroids, Cobben (1968) mentioned the presence of similar structures in Cixiidae, Delphacidae and Lophopidae.

METHODS

Eggs of *M. pruinosa* were field collected during early spring in the vicinity of Pisa, Italy. Eggs, still attached to flakes of bark, were placed in Petri dishes under laboratory conditions (18 to 20°C, R.H. about 70%). Progress in egg development was followed daily. Mature embryos used for scanning electron photographs were preserved in 70% ethanol, dehydrated in a graded ethanol series, dried by critical point method in a Balzers CPD 020 apparatus, and gold coated in an Edwards S 150B sputter coater. Ob-

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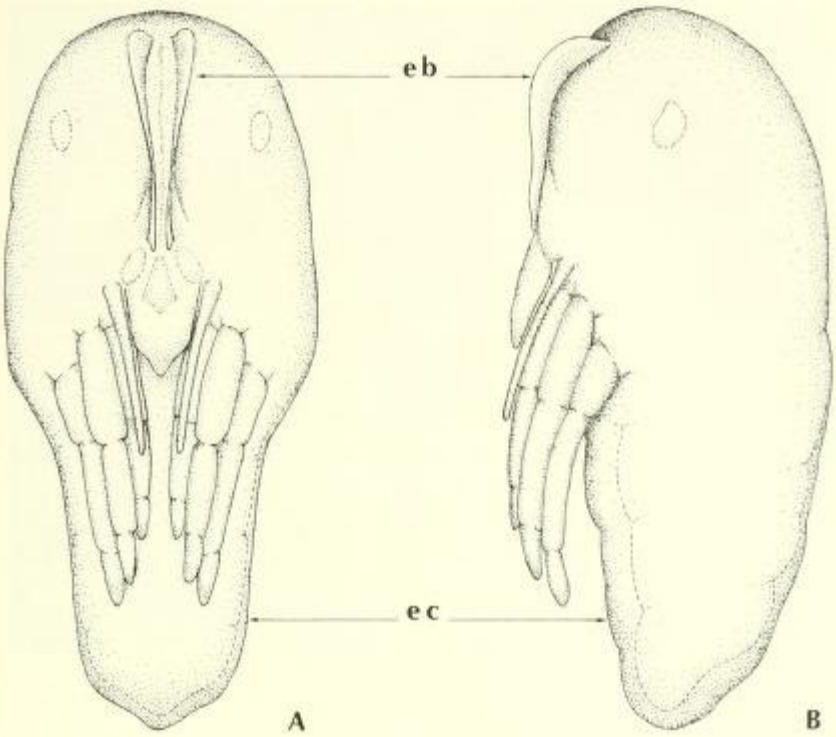

Fig. 1. *Metcalfa pruinosa* (Say). Ventral (A) and lateral (B) view of mature embryo enveloped in the embryonic cuticle (ec). The latter shows the egg-burster (eb) on the frontal region.

servations and photographs were made with a Zeiss Tessovar photostereomicroscope and a SEM Philips 505 B.

Results and Discussion

M. pruinosa is univoltine in Italy, overwintering in the egg stage (Zangheri and Donadini 1980). This behavior is similar to that reported for its native range (Dean and Bailey 1961, Wilson and McPherson 1981). In summer and early fall in Tuscany, Italy, dorsoventrally flattened eggs are laid singly in slits just under the bark of the host trees. They begin to hatch by early May the following year, and reach the adult stage, through five larval instars, in about 45 days (Lucchi and Santini 1993). Incubation of the egg between deposition and hatching lasts 240–300 days. During this period the egg is exposed to many environmental hazards from which it is protected by a very tough and thick eggshell. But this eggshell represents a serious obstacle at hatching time because of the embryo's lack of mandibles. In *M. pruinosa* a well developed egg-burster lying on the frontal region of the embryonic cuticle (Fig. 1) breaks through the eggshell.

The embryonic cuticle, itself entirely sur-

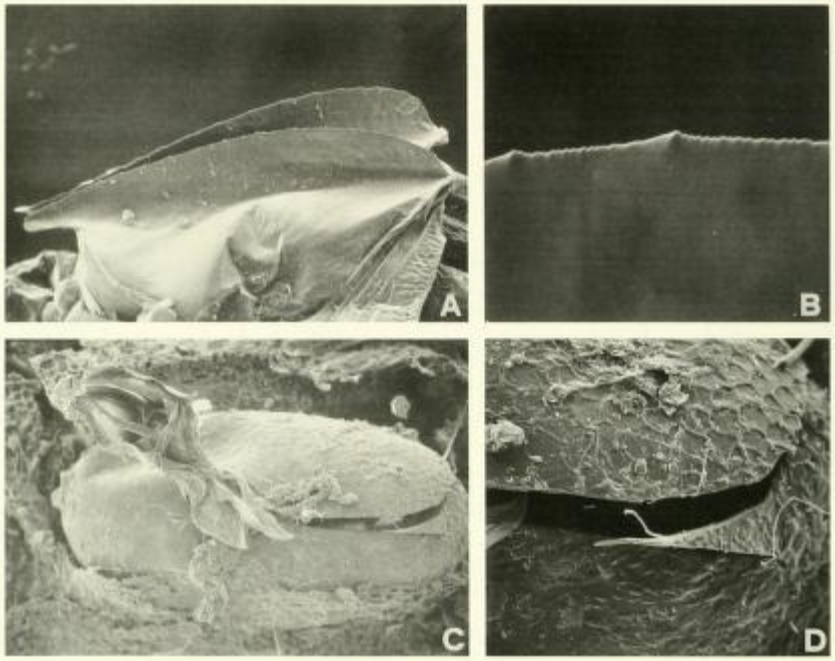

Fig. 2. *Metcalfa pruinosa* (Say). SEM micrographs of: A) lateral view of the egg-burster on a shed embryonic cuticle (×372); B) a detail of the egg-burster edge with blade teeth in evidence (×2200); C) an egg just after hatching (×120) and D) detail of the cut produced by the egg-burster (×300).

rounded by the eggshell, is a very thin pellicle provided with pouches ensheathing all appendages of the embryo. This is frequently the case within the Homoptera, even though in aphids the embryonic cuticle takes the form of a simple sac lacking extensions over the appendages (Snodgrass 1935). The midfrontal region of the embryonic cuticle of *M. pruinosa* is provided with a sclerotized egg-burster (Fig. 1). This egg-burster (about 0.3 mm in length) consists of two subparallel blade-shaped structures, one on each side of the median line, which are proximally convergent and present very sharp and serrated edges (Fig. 2A, B). At hatching time, the young larva, by muscular exertions, pushes the egg-burster against the inside of the eggshell until it finally pierces through. Following appropriate movements of the hatching larva's head, the egg-burster produces a longitudinal slit through the eggshell (Fig. 2C, D).

The larva rapidly exits the egg through the slit (Fig. 3A) while the embryonic cuticle simultaneously splits over the head. By means of vigorous muscular activity, the larva completes hatching within a few minutes (Fig. 3B). The ruptured embryonic cuticle is then shed and left shriveled, together with the egg-burster, on the empty eggshell (Fig. 2C). This process, known as the "intermediate moult" (Chapman 1969), occurs in most insects, even though in grasshoppers and cicadas the embryonic cuticle is retained as protection during the first larval movements and is shed shortly afterwards

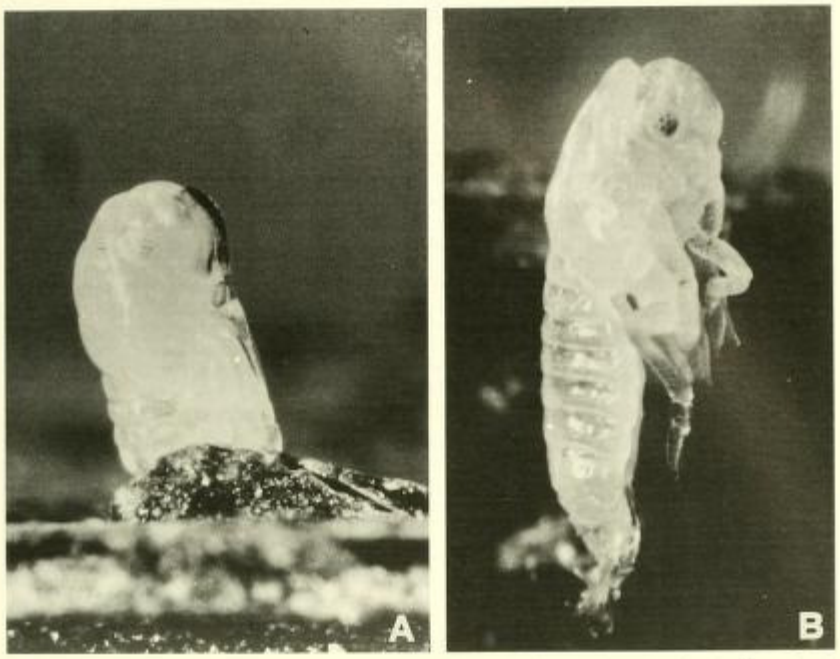

Fig. 3. *Metcalfa pruinosa* (Say). Two successive phases of hatching of a young larva (×40): A) still enveloped in the embryonic cuticle which bears the egg-burster on the frontal region and B) just after shedding of the embryonic cuticle.

(Snodgrass 1935). In the case of *M. pruinosa*, the embryonic cuticle, once divested, is free on the outside of the egg and easily lost through atmospherical events. This is different from the situation in Heteroptera in which the embryonic cuticle is divested and remains within the eggshell (Chapman 1969).

As concern the other Flatids, Muir and Kershaw (1912), as above mentioned, hinted at the presence of an egg burster in *Siphanta acuta*. In this case the structure is defined as a thickening of the cephalic portion of the embryonic cuticle, but its morphological detailed description is unfortunately missing.

In conclusion, within Fulgoroidea very little information is available to date on this peculiar structure. Further studies on the specific subject might be very useful also for taxonomic purposes within the Superfamily.

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