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## A 'missing link' in the evolution of the egg pedicel in lacewings?

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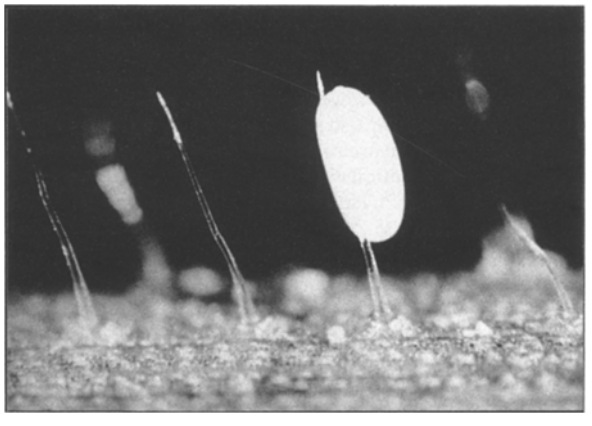
*Summary.* Brown lacewing eggs (Planipennia: Hemerobiidae) glued to the top of hairs of maize leaves can be seen as an intermediary evolutionary step between depositing the egg directly on the substrate (as in most neuropteroid families) and the protective behavioral adaptation of depositing the egg on a long thin pedicel (as e.g. in the Chrysopidae).
*Key words.* Egg pedicel; evolution; lacewings; Hemerobiidae.

In several families of the insect order Planipennia the females regularly deposit their eggs on thin hyaline stalks. Egg pedicels have been described for some genera of the Mantispidae, Berothidae, Nymphidae and, most noticeable because of their worldwide distribution and abundance, the Chrysopidae.
In the common green lacewing, *Chrysoperla carnea* Stephens, the eggs are mostly deposited on the bottom side of leaves and twigs. While the egg is about 1 mm long, the length of the pedicel, depending on the size of the female, ranges from 3.5 to 6 mm[2]. The selective advantage of a pedicel seems obvious, but few conclusive experiments have been published on that issue. The egg pedicel protects the egg from predation[3], parasitization and cannibalism[4]. In the larger part of neuropteroid families, however, the eggs are glued to the substrate without a pedicel. The scattered occurrence of egg stalks in rather distantly related families in the order Planipennia[5] suggests a polyphyletic origin of this trait.
To be of selective advantage an egg stalk must be of a certain minimum length to effectively prevent predation and parasitism. It seems barely plausible to think of gradual evolutionary steps leading from an unprotected nonstalked to a well protected stalked egg, unless even a minute stalk provides a selective advantage under specific circumstances.



Egg of *Micromus variegatus* glued to a hair on the upper surface of a maize leaf.

While regularly monitoring aphidophagous insects in maize fields in northwestern Switzerland, a peculiar type of lacewing eggs on tiny stalks of 0.5–1 mm length was observed in small numbers. Closer examination revealed that they were in fact hemerobiid (brown lacewing) eggs deposited on plant hairs on the upper side of maize leaves (fig.). The Hemerobiidae normally do not produce egg pedicels, but here obviously take advantage of the hirsute surface of the plant leaf. Out of a total of 22 hemerobiid eggs collected on maize in summer 1983, 14 were attached close to the tip of hairs.
Subsequent inspection of 100 egg stalks of *Chrysoperla carnea* on maize leaves showed that they also were predominantly (91%) placed on top of hairs. The bottom sides of maize leaves bear no hairs, which might explain the observation that on this crop, contrary to the general habit, only about 10% of the eggs of *C. carnea* were found on the bottom side of the leaves.
The Hemerobiidae thus may represent an intermediate evolutionary step on the way to producing an egg pedicel. The behavioral adaptations of gluing an egg to the tip of a hair may have triggered the development of behavioral traits to first prolong that hair with the hyaline mucus which is used to glue the eggs to the substrate, and later to build a pedicel even without the aid of a supporting hair. This interpretation would go along with the observation that several chrysopid species with adults of rather small size show a tendency to deposit their stalked eggs on spines of leaves or tips of conifer needles (e.g. *Cunctochrysa* in Europa, *Eremochrysa* and *Chrysopiella* in the USA)[4]. Even *Chrysoperla carnea*, known to deposit its eggs on a large variety of substrates which often bear no hairs, will go back to the 'ancient' behavior as soon as hairs are available.

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