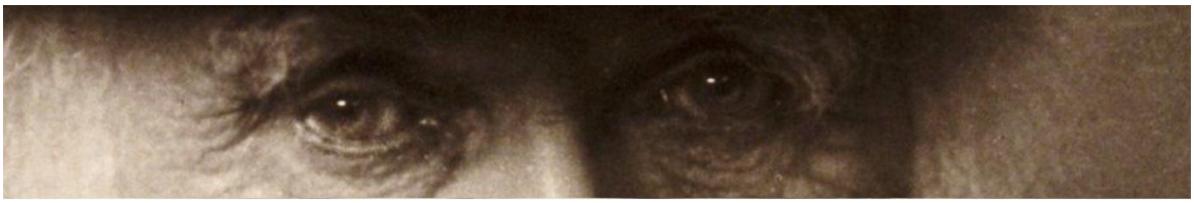

Charles Darwin *In Memoriam*

Evolutionary looks at the why of biological and cultural phenomena.

LEER EN ESPAÑOL

Two ways to be a velvet worm

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ABSTRACT: **There are two ways to be a velvet worm. One is to mate vaginally at a young age, give birth in any month and have small, scarce males. The other is to periodically inseminate through the body wall, with sexual equality in size and abundance. The second way seems to be an evolutionary adaptation to habitats that are colder and drier than the habitats of neotropical velvet worms.**

KEYWORDS: vaginal mating, periodic insemination, reproductive evolution, Onychophora.

Onychophorans have two basic patterns of reproduction; throughout the year, or at a particular time of the year. An obvious question is: Why are there two patterns? But an even better question is, why do not they reproduce year round? — Reproducing year round would allow a faster population increase and would be an evolutionary advantage. To answer this, let's look more closely.

FIGURE 1. **Two ways to be onychophoran: velvet worms of families Peripatopsidae and Peripatidae, respectively; photos WikimediaCommons.**

Some species mate while very young, with vaginal insemination, and females keep active sperm for more than 5 years. Babies are born throughout the year, and males, who are smaller, generally die young, so they are a minority in the general population. This is **one way** to be an onychophoran and is normal in the viviparous species from the neotropics, which have placentas and invest a lot in their offspring. There are also a few species outside the neotropics that seem to fit in this model (Evans, 1901; Lavallard & Campiglia, 1975).

On the other hand, although with exceptions, certain species tend to follow another pattern: they mate throughout their lives, with insemination mainly through the body wall, and females only keep sperm for the duration of the season, babies are born in the less dry or less cold season of the year, males are similar in size to females and are more or less equally frequent in the population. These species are usually ovoviviparous or oviparous, and the pattern is common in the southern family, Peripatopsidae (Manton, 1938). This is the **second way** to be a velvet worm.

Why has natural selection favored one way or another?

Reproduction at the more convenient part of the year has been favorably selected in many species, from plants to mammals, to face climates that are also seasonal. In onychophorans, reproduction represents an enormous expenditure of energy and matter, since mothers lose 6% of body weight for each newborn (Morera-Brenes, Monge-Nájera, & Sáenz, 1988). Under extreme stress, females expel all developing offspring and die after a couple days. This might give the most developed ones a small chance of survival. Limiting reproduction to the time of year where the climate and food are better is essential to survive, a necessity, rather than evolutionary strategy. This explains the seasonality of so many southern species of velvet worm that live in habitats that are colder and drier than the neotropical habitats.

Alternatively, the tropical species from humid zones, where climate and food are stable all year, also tend to reproduce all the year. This occurs even in seasonally dry tropical areas, because wet areas, such as gallery forests along rivers, persist throughout the year.

This model is maintained even within the same family, for example, in species that are not so distantly related. In South Africa, *Peripatopsis capensis*, which lives in a seasonally dry and cold climate, subject to forest fires, mates only around June and babies are born between March and April of the following year. In contrast, *Opisthopatus cinctipes*, which occupies a less seasonal subtropical habitat, reproduces throughout the year (Walker, 1995).

Like all models, our model is a simplification that allows both an understanding of what happens in nature, and a prediction of how reproduction is likely to be in species for which we just do not know. Surely there are species that have intermediate characteristics, either

because they live in intermediate habitats, or because they are in the middle of a process of adaptation. We still need many more observations to be sure, but undoubtedly, the seasonality of the habitat has shaped much of the way of being in past and extant onychophorans.

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