Arachnid Developmental Stages:
Current Terminology

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Perhaps no other aspect of arachnids is as confusing as the terminology of arachnids life stadia from egg to adult (and in the case of female mygalomorphs, Amblypygi [tailless whipscorpions] and at least one species of female filistatid [crevice spiders] beyond adult). The abundance of different names coined for the same life stage is little short of astounding.

I won't name all of the terms used (some by a single worker), but I will give you an idea what we have to deal with. Only spiders will be covered in any detail here. Concise information concerning the other 10 arachnid orders will follow.

The question at hand is largely about what to call the spider at various stadia of its life, especially the first two or three. Stadium (plural stadia) is the period between molts.

The egg is easily visualized by most, but the postembryo, at first blush, looks like an egg with a mite glued by its rear end to it; stubby legs extended and usually wiggling (eggs with legs is frequently seen in the enthusiast literature).

The 1st instar looks more like its adult counterpart, and by 2nd instar, and most definitely by 3rd instar, they look very much like the tiny spiders they are. This may sound straightforward to most, but many scientists just could not find it within themselves to adhere to its simplicity. They apparently decided it was far more elaborate and in need of further definition. Either that, or they didn't like those terms and believed everyone should use their own, more "professional" terms.

The spider egg is called the embryo, from the time of deposition to the rupturing of the chorion at eclosion (hatching) by Downes (1987) and Holm (1940) and many others.

An embryonic event called reversion begins a process where many species of spider embryos begin to elongate somewhat. Instead of just saying the eggs elongate somewhat, a post-reversion embryo was thought to be different enough to be its own stage, and was called a prelarva by Vachon (1957), and a pullus by Canard (1984) and Neet (1985).

These last two authors considered the embryo and the pullus as both falling within the "primary period" of spiders, also known, of course, as the egg.

The spider postembryo stage has inspired the coining or borrowing from elsewhere (mostly from insects) of many terms, including, by year: Quiescent stage or quiescent nymph then nymph by Ewing (1918) (Ewing was a well known American entomologist in that time period), incomplete stadia of the postembryonal stadia by Holm (1940), deutovum by Gertsch (1949) (Dr. Gertsch was a very famous American arachnologist), a larva then prenymph of the larval period by Vachon (1957), protonymph by Jézéquel (1960), interchorional stage by Galiano (1973), exchorionate stage by Hydorn (1977), endovitelline then exovitelline stages by Whitcomb (1978), postpullus then prejuvenile of the juvenile period by Canard (1984), and postpullus then prelarva of the juvenile period by Neet (1985).

Once past the first true molt and into 1st instar, things settle down a little. The most frequent alterations of 1st instar for people refusing to call them that, were complete stadia by Holm (1940), first nymph by Vachon (1957), first young of the juvenile period by Canard (1984), and first larva of the juvenile period by Neet (1985).

Not wanting to leave later stages alone, Vachon (1957) called the adult spider an imago, reminiscent of the mayflies (Ephemeroptera) which go through an adult-like subimago stage (wings and all) before molting again into the sexually mature adult form. I wouldn't be surprised to find the penultimate instar spider called the subimago by that author.

Unfortunately, this is by no means a complete list, and we haven't ventured from the Araneae yet.

In general, larva is a term usually reserved by entomologists to describe the immature stages of an insect with complete metamorphosis (e.g. the caterpillar of a butterfly or moth, the grub of a beetle); a nymph refers to many terrestrial immatures of an insect with incomplete metamorphosis (e. g. stink bugs, leafhoppers); a naiad refers to immature aquatic insects with incomplete metamorphosis (etc. dragonflies, damselflies).

Araneae (Spider) Development

Basically, the egg (embryo) hatches (sheds its chorion, roughly the eggshell) into the postembryo. After molting from the postembryo, an event called the first true molt, the spider is then termed 1st instar.

The term "instar" is defined as the organism between molts, or the organism itself during such a period.

After the next molt, it enters the 2nd second instar. In the 2nd instar, the yolk sac supplied by the mother runs out and the animal must begin to feed. The 2nd instar is also the stage almost all spiders emerge from the eggsac. After the next molt, the animal enters 3rd instar and so on.

The number of molts until sexual maturity is not necessarily set in most of the spiders tested, unlike many insects. Depending upon species and the sex of that species, there may be only a small number of molts, or, in the case of some spiders, over 20 (if appropriate, 19th instar is the name of an individual molting that many times). In many spider species studied, they don't appear to have a set number of molts until maturity, and this may have a lot to do with environmental conditions (lack of food, etc.).

Instar number stops when we reach the antepenultimate instar, which is the instar preceding the penultimate instar. The penultimate instar is the stadium prior to sexual maturity. After molting into the stadium in which it will become sexually mature (capable of reproduction), the spider is called an adult, or ultimate instar. This is logical, since the vast majority of species will not survive the ultimate instar. Tarantula females and others keep on going past ultimate instar, and continue into postultimate instars.

The first molt of an ultimate instar female is called the 1st postultimate instar, then 2nd postultimate instar, and so on.

Enthusiast Spider Terms

Some terms are frequently used that just won't go away, and maybe some shouldn't. Please ponder the small list below and come to your own conclusions.

Spiderling(s): This term is so entrenched, it will likely never drop out of use. People frequently refer to 1st through 3rd or 4th (or more) instars as spiderlings. Plain old "young" or "small immature" may be preferable to the term, but nobody will confuse the animals being called spiderlings with a postembryo or a large immature, let alone an adult. The term is here to stay and is not a bad one as these things go (although some arachnologists become highly irritated upon hearing it).

Sub-adult: This term is used widely by enthusiasts to indicate a large immature nearing the ultimate instar, but many new to the hobby don't know this. This term serves no useful purpose since any stage from egg to penultimate instar can be called a sub-adult.

Juvenile: See sub-adult.

Scorpiones (Scorpion) Development

Scorpions (except for one family of mites) are the only truly viviparous arachnid taxa (Polis 1990), meaning the young are born alive, no eggs are deposited.

At least two methods of development occur within the female, depending on species, but the end result is the same; 1st instar young drop out of the mother and ascend onto her back.

Terminology coincides with spiders from this point forward. As far as is known, no scorpion survives the ultimate instar, however, exceptions to this would not be surprising.

Opiliones (Harvestmen) Development

Harvestmen females have been cited as laying eggs in the soil, humus, snail shells, rotting wood and moss (doubtless, this is not a complete list). The egg hatches into a postembryo, usually termed "larvae" by many workers. The postembryo molts into 1st instar. Spider development terminology can also be used for harvestmen.

Whether or not any survive past ultimate instar is a matter of conjecture.

Solifugae (Windscorpion) Development

Windscorpion females deposit eggs in burrows they excavate, adapted existing abandoned burrows, or beneath rocks or rock crevices (Punzo 1998). The eggs adhere to one another in the form of a clump or pyramid. Apparently, no eggsac or membranous covering is constructed to protect them by the female. The egg hatches into a postembryo then molts into 1st instar. Spider developmental terms can be used throughout the life stages.

It is generally thought windscorpions do not continue past ultimate instar.

Amblypygi (Tailless Whipscorpion) Development

The eggsac of female tailless whipscorpions is secreted by the cells of the ovaries and oviducts as a filamentous viscous fluid (Weygoldt 2000). The eggs are oviposited at the same time as the eggsac and the eggsac later hardens. The eggsac is carried for a period of time, glued to the underside of the female's abdomen.

Still within the eggsac, the eggs hatch into postembryos, something Weygoldt calls deutembryos (he mentions other workers call the postembryo a larva or a nymph). The postembryo molts into 1st instar, called a praenympha by Weygoldt.

The 1st instars emerge from the eggsac and onto the mother's back, similar to what 1st instar scorpions do except for the eggsac part.

The 1st instar molts into 2nd instar and becomes free-living, leaving the mother, as also occurs with scorpions. Weygoldt labels the 2nd instar a protonymph.

The simple fact is all developmental terminology in amblypygids can be directly applied to spider development terminology. But there is one fascinating twist.

Weygoldt states both sexes of amblypygids continue to molt and grow after becoming mature (ultimate instar). Therefore, amblypygids also have postultimate instars.

Uropygi (Whipscorpion) Development

In the arachnid orders not well studied, obtaining reliable information can be difficult. Whipscorpions are one of those orders.

In whipscorpions, the eggs are exuded along with the membranous eggsac which later hardens similar to tailless whipscorpions. The eggs apparently hatch into postembryos and undergo another molt into 1st instar before emerging from the eggsac and climbing onto the mother's back or perhaps just staying close to her until molting into 2nd instar when they become free-living. Females may construct a brood chamber in nature.

It generally isn't thought that whipscorpions molt after the ultimate instar. It was thought that adults do not live long (days, weeks or months) after reproducing. However, I've kept adults alive and healthy for at least three years after they've reached ultimate instar. This may be an artifact of captivity.

One anecdotal report claims an adult female whipscorpion was kept in captivity for 19 years.

Pseudoscorpiones (Pseudoscorpions) Development

The female exudes a pouch externally from her abdomen that serves as a container for egg development. Some species supposedly abandon the eggs, but others use abdominal glands that secrete a kind of "milk" that feeds the immatures after they hatch from the egg. The development may be similar to whipscorpions, however, no information could be located on this aspect of the order as yet.

Schizomida (Shorttailed Whipscorpion) Development

The development stages in this order is suspected of being similar to whipscorpions.

Ricinulei (Hooded Tickspider)
&
Palpigradi (Micro Whipscorpion Development

I could find little or no useful information on the development of these small arachnid orders. These orders are found in the soil, plant litter and caves. Only one species of ricinuleid has been discovered in the US, in South Texas, and even then, only once by Willis Gertsch after heavy rains apparently drove them out of the soil.

Acari (Mite & Tick) Development

Acarologists use a bewildering amount of developmental terminology depending upon who you're talking to and what species. Discussion of any of it here is not appropriate for this article.

If you have more up-to-date information on arachnid development, especially in the minor orders, please let the editor know.

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