Where are Fireflies when we don't see them any more?

Firefly life cycles.

A life cycle of a firefly is the series of changes it undergoes from when the female lays her eggs until a female of the very next generation is laying her eggs again.

The life cycle of certain insects like beetles, moths and butterflies in particular has some amazing elements to it. When we are born (not hatched from an egg!) we are clearly a human and the changes that occur as we get bigger are gradual, but we are always recognizable. The other life cycle, say of a butterfly or the firefly, has various stages that look quite different to each other. It is a marvel of nature as the two main objectives of this life cycle, to eat enough to keep the adults functioning, and to mate and produce eggs to ensure the species continues to function, are put into separate compartments. Out of the egg hatches the stage that will feed. In butterflies this is the caterpillar, and if you have ever had something like the Cabbage white butterfly laying eggs on your garden plants then you will appreciate that all it does is eat and eat and eat! Whether it is a caterpillar or a firefly larva, there are differences to what the adult butterfly or firefly will be. In a caterpillar there are no wings, it is sexually immature, and it has jaws that allow it to chew through plant leaves. But look at the adult. It has two pairs of often beautifully marked wings, is sexually mature, can fly, and has an elongate piece of its mouthparts that is can coil and uncoil to imbibe nectar from flowers.

On the other hand the firefly larva sucks the juices of snails and slugs, is sexually immature, has no wings and can't fly, and can produce light as two tiny pin points from the second last segment of the body. The larval light does not flash in a regular rhythm. We may not even recognize that these other stages are fireflies. Their life cycle starts with the eggs laid by the female, which hatch into the feeding stage the larvae. This is the longest stage, and fireflies spend most of their life as larvae. Another stage is the pupa, which allows the transformation of the larva into the adult the stage we are most familiar with. Fireflies spend a very short time in this adult form which is specialized just for reproduction (our fireflies may not feed at all as adults).

The light displays we see in spring and summer when masses of males are flying around is a mating dance, the males flashing furiously hoping to be the selected suitor of a female.

Atyphella scintillans, our winter firefly, has a flightless female, which spends time on the ground usually with her light turned off, and only if she is impressed by the male display, will she turn it on (actually there is a very precise time interval between his flash and her response). While the male has a very clear pattern of flash on and flash off, so its trail in the air looks a bit like a dotted line, this female still produces pulses, but hers are much slower and of course they are at ground level. When a male spots her light he will fly down to the ground and undergo another round of furious flashing as he tries to find her and mate with her.


On the left is a fresh live specimen and thanks Martin Rady for finding it. On the right are pictures of two dried and sad looking specimens of the *Atyphella scintillans* female; their forewings are very short and there are no hind wings. The abdomen is large and swollen with fertilized eggs. Queensland museum specimens taken by LB.

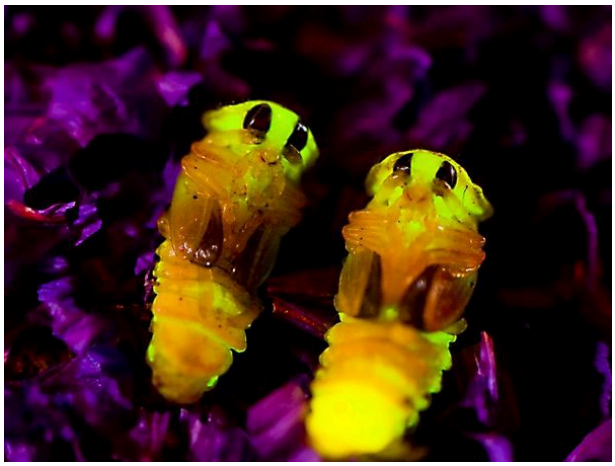
But these massed displays are not around for long. What happens for the rest of the year?

Eggs. It begins with eggs. The female firefly lays her fertilized eggs in the same area where you saw the wonderful display (as this female can't fly she is restricted to where she is). This means that these species are often in little pockets of bush and not widely spread,. In other species when the female can fly she is able to spread the species much more widely. The whole point of that massed display was to allow those eggs to be fertilised.

Larvae. The feeding stage that hatches from the eggs is the larva; this is the longest stage of this cycle; fireflies exist as larvae longer than as any other stage. Pictures below of an *Atyphella scintillans* larva active 4 April 2022 at Modanville near Lismore. Thank you Jarrah3000 who took these photos, posted them on inaturalist and allowed me to use them here. You can see the two pin points of light from the second last segment of the body.

Pupa (in butterflies you may call this a chrysalis). The pupa reassembles all the larval structures into those of the adult and ensures a complete transformation from a feeding, wingless sexually immature stage into a (usually) not feeding, winged and sexually mature adult. Here there is a type of melt down of all the larval features and a reassembling into adult features. It is a real wonder of nature. A quite wonderful transformation takes place. If it is a firefly then the larva has no wings, it has no reproductive organs, and quite small light organs which it can just turn on and off, but no flashing. The pupa reassembles all the larval structures into those of the adult, which has wings, large obvious light organs that can flash and of course a functional reproductive system.

The picture below is of a Chinese firefly species *Luciola curtithorax* and male (left) and female pupae, which as you can see luminesce throughout their body. They usually pupate underground. You can see the fore wings folded in front just behind the legs



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These are the stages we may not see and are happening when the main display phase is over. First the eggs hatch into tiny larvae, which are distinctively coloured, rather flattened, and whose only job is to eat! Calling them an alimentary canal on legs is not inappropriate. Since they live on tiny slugs and snails and earthworms, the larvae will be found in moist leaf litter.

Adult. The winged and flashing firefly we saw so much of since spring is possibly the only stage of this life cycle we may be aware of.

We are unsure with our Australian fireflies whether they are larvae for just one year or more likely for two. Close to when we are seeing the first males flying around, the larva has changed into that most wonderful stage, the pupa. And often just after rain when the soil has softened a little, out of the pupa comes an adult firefly, either male or female.

If you find any of these stages, it would be of great help to:

record the GPS coordinates

take a clear photo of the top (dorsal) side, and one side on (lateral), and one from underneath (ventral) side

if possible, collect one sample (maybe two if there's noticeable differences between the samples (not just size) and check the website: lesleyballantyne.com to find out where to send your sample

post your photos to Fireflies of Australia Facebook page and also to iNaturalist: inaturalist.ala.org.au/