



Scarlet rosefinch

Molecular Ecology in Prague

Pavel, Pavel and Pavel

“We think that colouration can influence success in extra-pair paternities,” bird expert Pavel Munclinger concludes from one of his studies. Another line of research, however, is about the emergence of species – in mice.

It is June. The lovely landscape of the Šumava Mountains National Park in the Czech Republic extends into the horizon. The Vltava river bubbles and the mosquitoes are ravenous for blood.

If you are a dedicated ornithologist, however, you don't mind the mosquitoes. Pavel Munclinger and his colleagues definitely are. Every year from the end of May until late July they leave their labs in the middle of busy central Prague to live in a little cottage without electricity and without running water for one purpose: to stalk little birds known as scarlet rosefinches (*Carpodacus erythrinus*).

No rewards for cheating

The Munclinger team is part of the so-called BRG (Biodiversity Research Group) that belongs to the Department of Zoology in Prague's Charles University. As part of a project by the Czech government to encourage people to stay in academic research, the BRG founding members received quite a bit of money to set up their lab back in 1998. From the beginning they were a bunch of small independent groups with strong ties to two institutes of the Academy of Sciences of the Czech Republic (ASCR), a public non-university scientific institution for basic research. That is why some of the group's researchers are more involved in the BRG, others more in the ASCR Institute of Vertebrate Biology or the Institute of Animal Physiology and Genetics. The former BRG leader Jan Zima, for instance, is now the head of the Institute of Vertebrate Biology. Today, Pavel Munclinger is the official BRG head but the group's core members include two other Pavels: Pavel Stopka and Pavel Němec.

“We just try to answer very simple questions from ecology,” Munclinger says modestly. Němec's group is mainly interested in the magnetic orientation of mammals. Their most important result so far has been the discovery of the parts of a mole rat's brain that are responsible for magnetic orientation (*Science* 294: 366-8). Stopka, his

wife and their co-workers, try to understand the role of urinary proteins in communication between mice and Munclinger approaches the ecological questions from a molecular point of view most of the time.

One of his research topics is reproductive strategies in birds. A new project, for example, deals with ducks that commit egg dumping – meaning they lay eggs not only in their own but also in their neighbour's nest. He is still reluctant to speak about that because the results have not yet been published. When it comes to his other bird project, however, he goes into raptures and here we are – back with the scarlet rosefinches. Put simply, their rosefinch projects are all about finding your dream man, faithfulness and infidelity.

Munclinger, together with Tomas Albrecht and other members of their team, can show that within the rosefinch population they are studying in the Vltava riv-

er valley, grown up males are brightly coloured. However, there is a lot of diversity: Their colour shade can vary from yellow to red. “We think the colouration can influence the success in extra-pair paternities,” explains Munclinger, “Carotenoids are responsible for the colouration which means that it is an honest signal,” because the birds get their colour from food. Therefore, only those who are fit during winter or who are not ill, for instance, will be beautifully red and this probably renders them attractive to females.

Some finches are lame ducks

However, there are other finch species whose females are a lot more “emancipated”. For example, the closely-related house finch (*Carpodacus mexicanus*) that lives in Northern America. Whereas the scarlet rosefinch females – once they have chosen a companion – stay with their mate, the house finch females are more flighty in the true sense of the word. During breeding, finch females stay in the nest and the male provides food. It seems that if the house finch male is not very successful in feeding the female, the female will desert the nest and start to

find another male as a social partner.

This is only possible, however, because house finch populations do not migrate and have an extraordinarily long breeding period. The scarlet rosefinch on the other hand migrates long distances and starts breeding very late. Therefore, the female probably needs to take the first available male as a companion but if he turns out to be a lame duck she will not have enough time to leave him and start all over again. The only other alternative in order to produce offspring with a better male – meaning fitter (and probably redder) – is cheating.

For their rosefinch studies, Munclinger and colleagues annually try to find every mating pair of their population. They will inspect every bush and once the nests are identified they will check them regularly. For example, they record the frequency of



Spot the three Pavels

er valley, there is no trade-off between the extra-pair and within-pair success of males (*Behavioral Ecology* 18: 477-86). That means that females who are cheated on by their male companion do not pay their mates back with a tit-for-tat affair – they stay faithful. Scientifically speaking, males who are good at extra-pair paternities are also good at within-pair paternities. At first glance, this seems astonishing because when a male is looking around for other females it has less time to look after its own mate. You could therefore predict that the female mate may be tempted to copulate with another male in the meantime.

The fitter the redder

So why is it that some males just seem better at reproducing? Whereas the plumage of both the female and the young male

food provisioning with little cameras and take blood samples from all the adults and the brood to check paternity with molecular methods back in Prague.

Trapping the birds is not that easy, yet another BRG-member, Radka Storchová, has even more ambitious plans. She has just started working on nightingales, which she tries to trap by attracting the male using playback. There are two nightingale subspecies in Europe that are still able to form hybrids but who probably are on their way towards two separate species.

Munclinger's second interest besides bird projects also concentrates on the emergence of species. Instead of nightingales he is studying it in mice. Of course this is not possible with common lab mice strains but it works very well with "the horrible mouse you can sometimes find in your flat". Actually, two kinds of house mice occur in Europe: *Mus musculus domesticus* in the west and south and *Mus musculus musculus* in the north and east. A narrow hybrid line of just about 20 kilometres in width, spans through the whole of Europe.

Side stepping into the mouse genome

"We think that those two forms are emerging species, just at the stage of speciation. They can hybridise but this is restricted to a very narrow hybrid zone," Munclinger says. He believes that one day the two forms will not be able to cross anymore. Today the hybrids are still able to reproduce but they are unfit. Munclinger and his colleagues now look at the hybrid's problems to find out how new species can emerge.

To do so, they first have to persuade local people living around and inside the hy-

brid zone to collect the mice. So far they have 100 such "suppliers" with whose help they have sampled thousands of mice.

At the moment, Munclinger and his colleagues sample the mice's genome at about 30 loci but they plan to increase this number to hundreds. They investigate how the frequency of the different forms of their genetic markers changes across the hybrid zone. If it changes very abruptly this could be a hint to a genomic region that is important in speciation. With this method they could show that for example the X-chromosome is more important than the autosomes.

Variant urine as force for speciation?

Quite surprisingly, there doesn't seem to be an obvious barrier along which the hybrid zone is formed. "We think it is maintained by an equilibrium between migration and selection," Munclinger says. The hybrid's reduced fitness could play a role in the fact that this hybrid zone doesn't get wider and wider. Then there could be a behavioural discrimination. Whereas from a morphological point of view, the two subspecies are literally not distinguishable, different communication through volatiles could be another reason for restricted subspecies mixing. Stopka and his team have just published this hypothesis regarding quantitative variation of major urinary proteins (MUPs) – that can act as pheromone transporters (*Journal of Chemical Ecology* 33: 861-9).

So far so good, yet there is much more going on in the Biodiversity Research Group as this is a very heterogeneous community. Still that's a topic for another Journal Club... ANNETTE HUPFER

One fine day in the lab...

by Leonid Schneider

