Sample paper critique #2

The article by Hayes, Nahrung and Wilson[1] investigates the response of three rodent species in Australia to the fecal odor of various predators. *Rattus fuscipes* (bush rat), *Uromys caudimaculatus* (giant white-tailed rat), and *Melomys cervinipes* (fawn-footed melomys) were tested with the use of infrared traps against a range of herbivore and predator smells in order to investigate whether the rodents' foraging behavior will be altered in the presence of a threat from predators. The experiment was based on the so-called "scat avoidance hypothesis", which claims that animals avoid certain areas after detecting the smell of predator feces in order to lower their risk of predation.

There were several questions that the authors were trying to answer through that experiment, the first one asking if rodents did respond to fecal smell at all. In case they did, further attention was to be paid to the seasonal variability in the rodent response to the odors, to the potential differences in their reactions to reptilian versus mammal predator smell, as well as to marsupial compared to eutherian predator odor, and finally to the importance of the familiarity of the smell. The results showed that the rodents did respond to fecal odor, avoiding the mammalian predator-marked areas, but they did not avoid reptilian and herbivore feces. The three species responded differently from each other and during the different seasons, which the authors suggest was a result of the life histories of the species.

The three species chosen for the test have several important characteristics that compare and contrast them. *M. cervinipes* and *U. caudimaculatus* were both introduced in Australia about 15 million years ago, and are referred to as "old endemics." The third rodent, *R. fuscipes* came to Australia only about 1 million years ago, and is a "new

endemics" species. *U. caudimaculatus* is the only species that has a life span of longer than two years. It is also the biggest of the three. *R. fuscipes* is the only one that can have multiple litters in one year due to its short life span.

The experiments were conducted in two areas, presenting very similar environmental conditions. The territories selected were rainforest areas with thick vegetation and a high canopy. The odor stations were set at a minimum distance of 25 m from each other, with infrared digital cameras set at a height of about 1 m above the ground at such a position that they would automatically start recording when a 50 cm line from the trap is crossed. The researchers set up blank sites along with the real experiment sites. In order to attract the rodents, they placed a piece of cardboard soaked in linseed oil at each site. The control odor was acetic acid, which is found in low amounts in the urine of many predator species. The other odors were from a mammalian herbivore (whiptail wallaby), the carpet python (reptile, predator), the dingo and the quoll (familiar predators, the former being eutherian and the latter marsupial), and the final two smells were from two unfamiliar marsupial and eutherian predators, the Tasmanian devil and the red fox respectively. All of the feces were taken from animals in captivity, where the predators were fed exclusively with rodents. The trapping was done in three seasons – in October 2003, May 2004 and November 2004.

A statistical analysis of the results was performed using ANOVA as the basic statistical tool. The results were proven to show significant traits in the rodent behavior. Overall, none of the rodents avoided the python odor, which the authors claim to be due to the small amount of feces that the reptile produces, which leads to a lack of familiarity with the odor by the test subjects. The novel and the herbivore odors were generally not

considered a threat and were thus not avoided, except by *R. fuscipes* in May 2004 and November 2004. The visit rate for *M. cervinipes* and *R. fuscipes* stayed high despite the odors, except for the avoidance of quoll feces in October 2003 and November 2004, respectively. All mammalian feces were avoided by both species in May 2004. The third rodent, *U. caudimaculatus* generally avoided mammalian species, both unknown and known, during the first two testing seasons. There was not sufficient data from November 2004 for analysis of the rodent behavior.

The authors of this article claim that the overall results show that rodents do avoid odor stations with predator feces. The results, however, vary seasonally and depend on the sympatry of the smell and whether the predator was marsupial or eutherian. They claim that there is most probably a factor in the predator feces that makes them recognizable to rodents and signals the need to avoid the area. The rodents were most cautious around the quoll feces, probably due to their long coexistence. In the late wet season, *M. cervinipes* and *R. fuscipes* showed caution to all predator feces, familiar or not, which, according to the researchers, may have to do with the fact that a large share of the population of each is composed of young and less experienced individuals, which tend to be more careful. By October or November, they have matured and their caution might be lower for the purpose of finding food and increasing reproductive chances since both have a very short life span. *U. caudimaculatus*, on the other hand, was always cautious against mammalian feces, which might have to do with the fact that they have a longer life span and thus the population is composed of more mature individuals, which do not need to expose themselves to an unnecessary risk, but would rather be safe in order to survive and be successful during the next mating season. Thus, the behavior of

the three species towards predator odors seems to be most strongly affected by their life histories and the season, in which the tests were conducted.

Overall, this article is clear, concise and informative. It is based on previous research, but has taken the former results to a more advanced level by introduction of new techniques and focusing on aspects, which were ignored in previous studies, such as the seasonal variability of the responses to the odors in relation to the life histories of the species. It seems, however, that the researchers did not manage to answer all of the questions comprehensively. For example, the issue of the predators being eutherian or marsupial was not addressed at all in the discussion of the results.

Using an infrared trap is also a very good idea, as it lowers the chance for the rodents avoiding the odors because of their placement in regular traps and allows for multiple visits by the animals in one night. However, the camera is set to start taking pictures only after a 50 cm imaginary borderline to the trap is crossed. If the rodents are able to sense the fecal smell from a larger distance, then they would not even cross the borderline. It is not clear from the article if the cameras were monitored by humans too, but it seems unlikely. This means that there could have been more visits by rodents, who chose to avoid the smell after sensing it from a distance, greater than 50 cm.

Another point that the authors raise themselves is that the species might mark the traps with their own smell and thus attract more species of their own kind and possibly repel others. This problem seems to be quite hard to solve since the tests are done in nature and there is no control over the behavior of the rodents around the trap.

A very interesting point that the authors raise has to do with the fact that the reptilian feces were not avoided, unlike mammal feces. This leads one to think that there

is a possible trigger in mammal feces that is easier to detect by the rodents that might lead to their avoidance. Another possibility could do with the fact that the fecal matter from the carpet python was the smallest in size. If the mass was too little, the rodents might not have been able to pick out the odor of the specific chemicals in it, and thus did not consider it as posing danger of predation and did not avoid it. The deposit from the whiptail wallaby was very small too, which could mean that the rodents did not manage to determine its origin. This paper contradicts the conclusions of Banks[2] from 1998, in which a similar study of *R. fuscipes* did not give any significant avoidance results, leading to the conclusion that the rodents cannot distinguish predator feces from others. Possibly equal masses of fecal deposits could have elicited a different response from the rodents and proven that they are oblivious to predator odor.

Still, the conclusions of this article seem to be reasonable based on the extensive testing that the researchers did. A further investigation into the rodent response to the reptile feces remains a necessary continuation of the testing. Also, involving other species with different histories in terms of their predator-prey interactions might provide a better idea of the motivation behind the rodent behavior in the presence of predator feces. Finally, predator mammalian feces could be tested for the presence of a special chemical that makes them recognizable by putting the predators, whose feces will be used, on a novel diet that does not include the exact subjects of the investigation. In this way, the rodents will not be able to "sense" the diet specificities of the predator, and if they avoid it nonetheless, then that would mean that another factor in the odor composition might be present that is as of yet unaccounted for.

References:

1. Hayes, R.A., Nahrung, H.F. & Wilson, J.C. The response of native Australian rodents to predator odours varies seasonally: a by-product of life history variation? *Animal Behaviour*, 2006, 71, 1307-1314.
2. Banks, P. B. Responses of Australian Bush Rats, *Rattus fuscipes*, to the Odor of Introduced *Vulpes vulpes*. *Journal of Mammalogy*, 1998, 79, 1260-1264.