Analysis Entomological Accuracy of the BBC Online News Article:

Grubs Fight Parasites with Food

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Introduction

Insects around the world have varying methods of defence. Some have developed protection methods on their own, whereas some have used different strategies. One such example is with herbivorous insects. They have evolved to be able to sequester plant chemical defenses used for protecting it from the insects, and utilize it for themselves against predatory insects (Gartside, 2000). Another instance is in parasite resistance. “Plant-derived pyrrolizidine alkaloids play an important role in the biology of the salt marsh moth, *Estigmene acrea*” (Jordan et al., 2005). Pyrrolizidine alkaloids are secondary metabolites that are seen in a wide range of plant taxa (Mattocks, 1986), including *Senecio longilobus*, which is favoured by the caterpillar (Hartmann et al., 2004). The other species mentioned in the article was *Grammia geneura*. They, along with using pyrrolizidine alkaloids, utilize iridoid glycosides to combat parasites (Bernays and Singer, 2005). Iridoids are a class of monoterpenes usually in the glycoside form that also occur in many plant taxa (Bowers, 1988).

The August 1, 2005 BBC News article, “Grubs Fight Parasites with Food” delves into the defence methods of tiger moth caterpillars. It explains how the caterpillar’s affinity for usually unpalatable plants is greatly increased when it is infected with a parasite. The original scientific article, “Insect Defences: Taste Alteration and Endoparasites” was done by Bernays and Singer. It was published in Nature 436, 476 on July 28, 2005.

Comparing the Popular Press Article with the Scientific Paper

The popular press article was written to entice an individual that does not have an above average interest in the sciences. It does a good job of exploring the interesting conclusions of the experiment. However, there are some glaring inconsistencies that a scientist experienced in the field could pick out. The press article tells us that *G. geneura* and *E. acrea* live in the grasslands
of southern Arizona. It does not mention that *G. geneura* can also be found in southwestern parts of the United States, as well as northern Mexico in grasslands and woodlands (Stireman and Singer, 2002). The popular press article does not use the proper term for the parasitic fly infecting the caterpillars. They continually use the phrase parasite, while the proper word to describe the fly would be parasitoid. A parasitoid is defined as an animal that lives “at the expense of another animal (a host) that eventually dies as a result” (Gullan and Cranston, 2005).

BBC reports that the parasitic flies lay eggs on the outside of the caterpillar. Upon hatching, they bore into the caterpillar and feed in its tissues. This information is correct. However, it then states that the parasite larva pupates inside the caterpillar before bursting out of it. This is misleading; the larva of the parasitic fly in this experiment emerges from the caterpillar before pupating nearby (Drees and Jackman, 1999). The article also mentioned that the woolly plantain plant, *Plantago patagonica*, produces pyrroloizidine alkaloids and iridoid glycosides. This is not so, as shown by Singer and Stireman in 2003. Although some plants have both chemical groups in them, *P. patagonica* is not one of them. The woolly plantain only contains the iridoid glycosides (IG’s), not the pyrrolizidine alkaloids. The pyrrolizidine alkaloids do occur in the plant *S. longilobus*, which was noted before as the favoured plant for feeding by Hartmann in 2004. The BBC informs us accurately that the caterpillar’s taste cells alter their responsiveness to feeding stimulants and deterrents. However, the original scientific article by Bernays and Singer explains that the alteration does not affect the whole sensory cell. Sucrose was used as a control to see if there was a change in the caterpillar’s affinity for a regular compound. Since the change in the phagostimulatory nutrient sucrose was not consistent, it dismissed the likelihood that the adjustment affected the whole cell (Bernays and Singer, 2005). It was noted that the modification might be caused by a change in the particular receptor protein or its second
messengers (Bernays and Singer, 2005). The article mentions that the caterpillars eat the alkaloid plants when they have a parasitoid infection, and avoid them otherwise. Conversely, it was found that they are polyphagous and *E. acrea*, if not both, obtain the pyrrolizidine alkaloids (PA’s) as a result of chance encounters with the sparsely distributed plants containing them in the habitat (Bernays *et al.*, 2002). This means that the caterpillars will eat the plants whenever they come in contact with them, since they need the chemicals for defence against other insects as well. The scientific article stated that the caterpillars have increased consumption of the plants, suggesting that they do not avoid them until they are infected by a parasitoid (Bernays and Singer, 2005). Another discrepancy in the BBC article was that they insinuated that both species of caterpillar use the PA’s and IG’s. However, even though both use the PA’s, only the caterpillars of *G. geneura* use the IG’s (Bernays and Singer, 2005).

**Improvements on the Popular Press Article**

There are a few instances in which the article could have been made better. The BBC explains that, when there is a parasitic infection, the host’s behaviour is usually changed to benefit the invader. They could have mentioned an example, such as the nematode hairworm. This worm makes the host grasshopper jump into the water so that the parasite can emerge and find a mate in the water, which it is better suited for (Houseman, 2005). Another improvement would have been mentioning the type of parasitoid that infected the tiger moth caterpillars. It was found that “the parasitoid assemblage of *G. geneura* was dominated by tachinid flies both in composition and overall parasitism rates” in Arizona (Stireman and Singer, 2002), the area in which the article mentioned the caterpillars inhabit. The article could have pointed out that the favoured plant for the caterpillars was *S. longilobus* (Hartmann *et al.*, 2004), instead of mentioning the woolly plantain, which does not contain PA’s as was stated (Singer and Stireman,
The article could have also established that the chemicals sequestered from the plants have multiple uses besides fending off parasitoids. The PA’s facilitate development of male androconial organs and also affect the mating behaviour of adult males (Jordan et al., 2005). The PA’s also provide deterrence to invertebrate predators such as spiders (Eisner and Eisner, 1991), while the IG’s dissuade vertebrate predators such as the gray jay (Bowers and Farley, 1990) and invertebrates like ants (Dyer and Bowers, 1996).

Conclusions

The BBC News presented a popular press article that was interesting and would catch people’s attention. The editorial did misrepresent some information, although not vital. The proper term for the parasite would have caused the average reader to question what the word meant. The article was not as thorough as it could have been. It restricted the habitat of the tiger moths to southern Arizona, when it is much larger than that. More interest could have been provoked if there was an example given for the parasite changing the host’s behaviour. The chemicals of PA’s and IG’s were not explained well. The average person does not know any background information on the chemical families. A short explanation of their integration into the caterpillar’s skin would have helped in understanding the mechanism. However, if a person views an article to be long, they will be less inclined to look at it than if it was short. This could explain the omissions of further examples to build up the story. The piece on plants containing the chemicals was not accurate, but has no effect on the experimental results. The largest mistake made was leading people to believe that the caterpillars only eat the alkaline plants when they have a parasitic infection, which is untrue. The infection increases their affinity to find and consume, but is not by any means just due to the parasitoid.
Credentials of the Entomological Authority

The main source for the BBC News article was Insect Defences: Taste Alteration and Endoparasites by Elizabeth Bernays and her colleague Michael Singer in 2005. Elizabeth Bernays obtained her B.Sc. at the University of Queensland, Australia. She earned her M.Sc. and Ph.D. in Entomology at the University of London, UK. She is currently at the University of Arizona as a research professor, where she has published many journal articles. The Arizona University website shows she is currently studying the neurophysiology of taste receptors in caterpillars, and the role of parasites and predators on host foraging behaviour.

Michael Singer attained his Ph.D from the University of Arizona. He is currently at Wesleyan University as an assistant professor. He has worked with Bernays numerous times, as well as other leading scientists in the field. The Wesleyan website shows his current interests to be to understand the organization of ecological communities and evolutionary diversification, and the interactions between plants and insects.

References


