Feeding characteristics of a generalist pit viper, mamushi (*Gloydius blomhoffii*), to different prey types

Kyosuke Hamanaka

Introduction

Feeding behavior of predators has evolved to adapt to their food habits. Prey-specific tactics are especially common in dietary specialists, but quite a few generalist feeders have been known to have behavior specific to each prey animal. Generalists are possible to use different tactics to different prey types in detecting, orienting, catching, and ingesting prey. Their decision what tactics is recruited would be made depending on the prey characteristics.

Food habits of snakes vary from invertebrates to mammals among species. There are many generalist species that feed on various taxa, whereas there are also many specialists. Natural diet of several generalist snakes includes both vertebrates and invertebrates. However, many aspects of intraspecific differences of their prey recognition and feeding behavior on different prey types have not been well studied.

Most of viperid snakes are generalists, and their food habits are different among species. Several species feed on arthropods in addition to their main prey, vertebrates. However, feeding behavior of vipers has been intensively studied on a few genera distributed in North America and Europe. Furthermore, the main focus of those studies has been predation on rodents in most cases. Thus, information on feeding behavior of vipers distributed in other regions and on other prey types is limited. In this study I

investigated behavioral differences to different prey types using a Japanese pit viper, mamushi (*Gloydius blomhoffii*), which feed on various vertebrates and centipedes.

Materials and methods

I conducted four experimental studies on feeding behavior of the mamushi. First, to examine difference of the effects of chemical and thermal cues on responses of the mamushi between endotherms and ectotherms, I conducted a chemical preference test with thermal information, using chemicals of mice and frogs.

In the second study, I examined predatory strike and prey handling behavior of the mamushi to different size of mice, and compared these behaviors with those of another Japanese pit viper, himehabu (*Ovophis okinavensis*).

In the third study, I tested toxicity of the venom of the mamushi to centipedes, which are the only invertebrate in natural diet of the mamushi.

In the final study, to examine the response and predatory behavior of the mamushi to centipedes, I conducted a chemical preference test, prey presentation test, and encounter experiment.

Results and discussion

When thermal information was present, response level of the mamushi was significantly higher to mouse chemicals than frog chemicals. The snakes would

recognize prey types by chemical cues, and thermal cues would be utilized to orient prey only when the prey type is an endotherm.

There were several differences in feeding behavior on rodents between mamushi and himehabu. For instance, the mamushis always released rodents after quick envenomating strike, whereas most of the himehabus held rodents after strike. These differences may be due to the difference of their food habits.

Toxicity of the venom of the mamushis was significantly lower to centipedes than to other prey types, mice and frogs. This result suggests that the evolution of effective venom is slower to prey animals that are physiologically different from other major prey taxa.

Response of the mamushis to active centipedes were usually low, and predatory strikes were rarely elicited. Because the snakes showed relatively strong response to tied or dead centipedes, it is possible that the snakes target only distress or dead centipedes.

Conclusion

It was clarified that the mamushi has different tactics for different prey types in prey recognition, predatory strike, and prey handling. Each tactics was suitable for each prey type. The evolution of their feeding behavior would have been highly coordinated with the food habits.