

We tested for aggression biases in red and blue cichlid males of the genus *Pundamilia* from Lake Victoria [1, 2]. Territorial males of a pair of partially reproductively isolated species with red and blue nuptial coloration respectively, studied in the laboratory, were confronted simultaneously with both color types enclosed in transparent tubes. A video of ten minutes was recorded.



Figure 1. *Pundamilia nyererei* (blue) and *Pundamilia pundamilia* (red).

The videos were analyzed with a Video Interface and Time Code Generator using The Observer®. The following behavioral patterns were recorded: display behavior (i.e. frontal and lateral display) and attack behavior (i.e. biting and butting) at the walls of the tubes that contained the stimulus males. The Observer yields both time budgets and frequencies of behaviors.

MATERIALS AND METHODS

To analyze whether a bias exists in aggression, we first generated response ratios based on frequencies of as well as time spent on both display (we pooled the data on lateral and frontal display) and attack behavior. The display duration ratio of each male was expressed as the time spent displaying towards a red stimulus (D_r) relative to the total time spent displaying towards both stimuli, calculated as:

$$[D_r / (D_r + D_b)]$$

D_r = total duration display towards red male

D_b = total duration display towards blue male

We calculated the display frequency ratio in the same way by using frequencies of displays. The attack

duration and frequency ratios were generated in an analogous way. We also generated information on latency to first attack. Such information can be readily generated from The Observer output datasheets. Data can be found in Dijkstra *et al.* [1].

RESULTS AND DISCUSSION

We think The Observer is an excellent system to examine behaviors in both frequency and duration budgets. In many behavioral studies only one of these is presented, but we presented both in our study. We found that duration and frequency data strongly correlate (Pearson correlation: attack: $r=0.678$, $P<0.0001$; display: $r=0.716$, $P<0.0001$, $N=61$). We nevertheless preferred to show both response types; we did not detect significant difference in the number of attack behaviors, but the difference was apparent in the time budget (or vice versa). Furthermore, The Observer allows for examination of many behavioral variables, some of which appeared to be very important to our research questions. For example, when examining the latency to first attack, we detected the expected patterns, although we did not intend to look at latency times beforehand [1]. In general the system worked very well. Currently, The Observer is used to test for lateralization in cichlid fish and chickens

REFERENCES

1. Dijkstra, P.D.; Seehausen, O.; Gricar, B.; Maan, M.E.; Groothuis, T. (2006). Can male-male competition stabilize speciation? A test in Lake Victoria cichlids. *Behavioral Ecology and Sociobiology*, **59**, 704-713.
2. Dijkstra, P.D.; Seehausen, O.; Pierotti, M.; Groothuis, T. (2007). Male-male competition and speciation: aggression bias towards differently coloured rivals varies between stages of speciation in a Lake Victoria cichlid species complex. *Journal of Evolutionary Biology*, **20**, 496-502.

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