AGONISTIC DISPLAYS IN THE ROCK BASS, AMBLOPLITES RUPESTRIS

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Abstract

Agonistic encounters between pairs of adult rock bass, Ambloplites rupestris were observed and the behaviour and changes in coloration of the dominant and subordinate individuals analysed. Dominance coloration involved the establishment of a high degree of visual contrast, whereas subordinate coloration made the animals darker and their coloration less striking, thus perhaps serving a protective function.

Introduction

Few studies exist on agonistic behavior and the signal value of coloration in centrarchid fishes. Miller (1963) observed the behavior of some Lepomis species and the pigmy sunfish Elassoma evergladei, noting color changes during sleep, aggressive encounters, courtship and spawning. Henderson & Chiszar (1977), Poulsen & Chiszar (1975), and Stacey & Chiszar (1975) have reported on numerous aspects of aggressive behavior in the bluegill sunfish Lepomis macrochirus. The present study describes agonistic behavior and color change in the rock bass Ambloplites rupestris.

Methods, results and discussion

The aggressive behavior of 12 adult rock bass, Ambloplites rupestris (Rafinesque), ranging in length from 110-130 mm S.L., was observed for two half-hour sessions (on successive days) in 10 gallon aquaria with light colored gravel bottoms. Two rock bass were housed in each aquarium 10 days prior to observations and were separated by a perforated, opaque plastic partition. The partitions could then be easily removed and aggressive encounters observed with no handling of the fish taking place. To prevent extraneous effects on the fishes' behavior, tanks were covered with white cloth and observations were made through a small hole cut in the cloth.

Prior to the removal of the partitions, individuals had light coloration, matching their background of light colored gravel, and a small dusky spot on the tip of the operculum. Eyes (irises) were gray except in the lateral portions which were slightly red. Upon removal of the partitions, threat displays were immediately initiated; no period of inactivity or initial orientation and approach took place such as occurs in aggressive encounters of bluegill sunfish, Lepomis macrochirus (Stacey & Chiszar, 1975). In the first encounter, aggressive displays were 'caudal fin beating' (head to head or head to tail) and 'thrusting' (Miller, 1963). All fins were erect during the actual beating, but as soon as four or five beats were made, the pelvic fins would be appressed to the body for a few seconds, then erected again as more beating occurred. 'Thrusting' behavior is characterized by the aggressor swimming a short distance toward the aggressee as if to attack, but then either stopping short or veering to one side. These two displays were alternated throughout the half-hour period. Usually dominance relationships were established within 10 minutes, as evidenced by one fish engaging in all aggressive acts. The subordinate individual
would then remain either near the bottom or near the surface in one corner with the caudal fin appressed to the aquarium side, a behavior noted in other centrarchids in aquaria where no cover was available (Casterlin & Reynolds, 1978). During some first encounters, the aggressor would station itself as far as possible from the aggressee and start ‘yawning,’ a behavior described by Miller (1963) as a comfort movement, frequently occurring when fish are under stressful conditions.

Coloration differed considerably between aggressor and aggressee. The aggressor had light coloration with contrasting horizontal bands of dark spots extending the entire length of the body, and the dusky spot on the opercular flap became larger and darker. The most notable feature of the aggressor was its red eye. As soon as dominance was established, the lateral red portion extended further around the iris and all dark pigment disappeared so that the red appeared more prominent against a white background. The aggressee’s iris would become darker, obscuring the red color. In the most subordinate individual, the eye would be almost completely black. The rest of the body was also dark with a vertically mottled pattern, making the opercular tip indistinguishable and obscuring the exact location of the eye.

In the second encounters between the same antagonistic pairs, the subordinate individual showed no retaliation and rarely even attempted to flee as the aggressor alternated between caudal fin beating with spread opercles and lunging, biting at either the tip of the operculum, the base of the dorsal fin, the soft dorsal itself, or at the eye. The aggressor’s attacks became so vigorous that the subordinate fish was forced against the tank side in either a head-down position or partially out of the water. The aggressor would occasionally attempt to initiate mouth fighting. In this case, or if suddenly bitten hard in any other area, the red of the aggressees eye would appear for 2-3 seconds followed by an even greater darkening of the iris, making it indistinguishable from the rest of the darkened body. Rapid color changes such as this are controlled by the nervous system (Knowles, 1959). This further darkening and obscuring of the eye region could perhaps serve a protective function, as the aggressor no longer directed attacks at the eye of the aggressee. It is unclear whether this is because the aggressor cannot see the cryptically darkened eye of the aggressee, or whether the darkened eye is a submissive display (or component thereof) which actually inhibits attack by the aggressor, or whether it is merely a question of a lack of red signal coloration to elicit attack.

Caudal fin beating in *Lepomis gibbosus* and *L. humilis* (other centrarchids) serves almost exclusively to establish dominance relationships (Miller, 1963), but in the rock bass this aggressive display was also used to maintain dominance after it had been established. In the bluegill *L. macrochirus*, the opercular flaps and the base of the dorsal fin darken in dominant individuals, suggesting aggressive signal value denoting dominance status (Stacey & Chiszar, 1975). The opercular flap of rock bass was darker in dominant individuals, and may serve a similar function. Red is a highly visible signal color in shallow fresh water, and occurs widely in the Centrarchidae, either on the tip of the opercular flap or in the iris of the eye. We have observed red coloration in the irises of smallmouth black bass (*Micropterus dolomieu*), and of bluespotted sunfish (*Enneacanthus gloriosus*) in agonistic situations; in these cases, as in the rock bass, it seems to denote aggression or dominance.

Following the second encounter, the fish were again separated. Dominant individuals returned to normal (pre-encounter) coloration within a half-hour. Subordinate fish, however, retained a chronically darkened coloration, would not feed, and hovered near the surface in a corner of the aquarium for a month or more. In contrast to the rapid nervous system mediated changes in coloration exhibited during agonistic encounters, this chronic darkening may have been hormonally mediated (Knowles, 1959), possibly reflecting tissue damage (Stacey & Chiszar, 1975). Prolactin has been implicated in melanogenesis (Ball, 1969; Schreibman, 1964) in fishes, and injection of it also reportedly inhibits aggression and feeding in cichlid fishes (Blum & Fiedler, 1965). Thus, a chronic hormonally-mediated after-effect on coloration and behavior may perhaps be initiated in subordinate fishes following agonistic encounters with more dominant individuals.

In conclusion, dominance coloration in the rock bass involves a high degree of visual contrast, wherein horizontal bands of dark spots and the dark opercular flaps contrast with a light background color, while the red pigments in the iris are unmasked by a diminution of dark eye pigmentation. Subordinate individuals are darker and more cryptically colored, with the eye and opercular flap blending in with the dark background body color, rendering less visible body parts which otherwise would be frequently attacked by aggressors.