

Short Communication

The effect of prior victory or defeat in the same site as that of subsequent encounter on the determination of dyadic dominance in the domestic hen

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{BP984 re-submitted on 29 December 1994}

Abstract

We examined the effect of prior victory or defeat in the same site as that of a subsequent encounter on the outcome of dyadic encounter of domestic hens by placing them in two situations: In the first set of dyads, two unacquainted hens having experienced prior victory were introduced in the site where one had experienced victory. In the second set, two unacquainted hens having experienced defeat were introduced in the site where one had recently lost. Results indicate that victories are equally shared between individuals with prior victory experiences, while familiarity with the meeting site did not give any advantage. However, hens having previously lost were disadvantaged when the encounter occurred in the same site as that of their prior defeat. This demonstrates that previous social experience in a site is more important on the outcome of subsequent encounters for losers than winners. Losers seem to associate the site with the stressful effect of losing or being more easily dominated.

Key words: Prior experience of victory and defeat; Locus dependent dominance; Agonistic behaviour; Hen; *Gallus domesticus*

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Introduction

Various studies indicate that aggressive dominance is significantly increased in residents of flocks of fowl against familiar or unfamiliar newcomers (Schjelderup-Ebbe, 1922; Allee et al., 1939; Guhl and Ortman, 1953; Guhl, 1961; Banks et al., 1979; Rajcecki et al., 1981). Surprisingly, the only experimental study reporting some advantage of a 22 h prior residency in this species is that of Zayan et al. (1983). However, in their study only the intruders were physically handled and the same hens were repeatedly used. Therefore it is not clear whether the advantage that enabled them to dominate came from: (a) familiarity with the battery cage; (b) familiarity plus not being handled; or (c) previous dominance experience associated with the cage. There may even be an association with being handled.

In the *Xiphophorus* fish genus, Braddock (1949) showed that prior residence in an area ensured an individual of a greater probability of aggressively dominating conspecific. However, only intruders were handled in these experiments. Zayan (1975b, 1976) demonstrated that these effects disappeared when both fishes, resident and intruder, were simultaneously manipulated after a 22 h residence. Nonetheless, Zayan (1976), Beaugrand and Zayan (1985), as well as Beaugrand and Beaugrand (1991) confirmed that dominance was significantly more frequent for residents when they were equally and simultaneously handled with intruders, but paradoxically when previous familiarization with the residence tank was only of 3 h duration.

The mere fact of being familiar with a site probably advantages an individual because that individual is not subjected to the stress of adapting to a new environment and is therefore less susceptible to experience fear than the newcomer (Thinès and Heuts, 1968; Beaugrand and Zayan, 1985). It can then concentrate more rapidly on the new situation (Rowell, 1974). On the other hand, chasing an animal for its capture, handling it, and introducing it as an intruder into an alien environment is surely a stressful experience, whose effect can be confounded with that of non-familiarity (Zayan, 1975b). Differences in prior experience associated with the site of residence can also be confounded with that of familiarity (Bronstein, 1987). It is well known that prior victory increases chances to win again while prior defeat increases that of future defeat in fish (Francis, 1983; Frey and Miller, 1972; Thinès and Heuts, 1968; Beaugrand and Zayan, 1985; Beacham and Newman, 1987), mouse (Brain and Kamal, 1989; Brain and Parmigiani, 1990) and in hens (Ginsburg and Allee, 1942; Ratner, 1961; Zayan, 1987). These effects were demonstrated in tests where prior winners and prior losers were introduced in an alien and neutral meeting place; prior winners systematically defeated prior losers.

Animals can readily make simple associations between various stimuli and positive or negative contingent consequences. When presented with these stimuli, they react in an adaptive manner by willingly approaching positive ones or avoiding negative ones. This study compares two prior residence situations: In the first, the locus of residence and meeting place was positively associated with victory by the resident and was neutral for the intruder. In the second, the locus of residence was associated with defeat for the resident but remained neutral for the intruder. Such an association of the residence locus with experience can lead to predictions that are more different than accountable by familiarity alone when other asymmetries are neutralized. Based on familiarity alone, one can predict that residents will

significantly defeat intruders when both are prior winners (α) as well as when both are prior losers (ω). However, based on the association of the locus with specific positive (victory) or negative (defeat) experience, divergent predictions are made for α and ω . Since the meeting place is positively associated by the α residents but negatively by the ω , while remaining neutral for intruders of both kinds, residents should defeat intruders when both are prior α but intruders should defeat residents when opponents are ω .

Material and Methods

We used 150 mature hens from a local flock of Red Rock x Light Sussex. They were kept in six deep litter pens (2.4 x 3.2 m), each holding 25 hens. The encounters were carried out in cages made of wood and fibreglass (70 x 75 x 75 cm and 70 x 100 x 100 cm) with an aluminum door.

Two hens used in the same dyad did not meet for at least two weeks, based on previous observations that hens no longer recognize penmates after that period (Chase, 1980). We paired hens with similar comb size and weight, i.e. showing a maximum of 10% weight difference, which represents a maximum of 300 g.

We tested two conditions. In the first condition (α - α), two unacquainted hens which had experienced victory (α) were introduced in the site where one of them had won its previous conflict. In the second condition (ω - ω), two unacquainted hens which had experienced defeat (ω) were introduced in the site where one of them had been defeated. For each condition, we divided the experiment into two phases, which were performed on the same day. Both conditions were run simultaneously. In the first phase, the hens acquired social experience of victory or defeat during a period lasting for a maximum of 3 h. In the second phase, we separated the hens of each dyad and isolated those selected for the second phase for a maximum of 15 minutes. For the α - α condition, we paired two previous winners of the first phase; and for the ω - ω condition, two losers of the first phase were paired. In order to minimize the effects of physical manipulation of the hens on the results, the intruder as well as the familiar hens were equally handled. The dyads of the second phase lasted for a maximum of 3 h or until the dominance criterion was fulfilled whichever came first. Dominance criterion was satisfied for a given pair when the winner delivered three consecutive attacks using any combinations of the following behaviours: peck, jump on or claw (Chase, 1980), followed by a 30 minute period during which the loser did not attack the initiator. No injuries were noted and no death occurred during the experiment.

Results and Discussion

The results are summarized in Table 1. We realised a total of 70 dyads, 35 for each α - α and ω - ω conditions. A total of 34 dyads of the α - α condition and 16 dyads of the ω - ω condition resolved before the 3 h allotted time period. A victory experienced in the meeting site and being familiar with it, as in condition α - α , is not an advantage for a hen over another that has won elsewhere (H_0 : $p=q=1/2$, 18:16, binomial, n.s.). On the other hand, it is disadvantageous for prior ω hens to encounter another prior ω hen in the site where they experienced defeat (H_0 : $p=q=1/2$, 12:4, $P<0.038$ to a binomial one-tailed test). One word of caution is in order about a methodological limit in the present research that may preclude drawing inference on the effect of losing in the same site as a previous defeat. Indeed, there may have

been a selection of subordinate individuals that could account for the significant number of ω - ω encounters that did not resolved before the allotted time period (Chi-sq=16.2, df=1, $P<0.001$). This difference may reflect the asymmetrical effect of winning and losing as observed by Bakker et al. (1989) who found that the effect of losing may persist as long as 24 h in fish. Similar, but longer effect were observed in mouse (Brain and Kamal, 1989; Brain and Parmigiani, 1990). Chase et al. (1994) showed that the effect of winning may last for 1 h or less. Therefore, it is possible that many of our ω hens did not recover from their previous experience of subordination after 3 h, hence explaining the large number of unresolved ω - ω dyads we obtained. The asymmetrical effect of winning and losing also seems to affect the behaviour of individuals. We observed that ω hens were far less likely to engage in efforts to dominate while most α hens readily engaged in agonistic interactions. Many α - α encounters were solved by fights while no fight occurred in the ω - ω encounters. The ω - ω hens seemed to use less aggressive (or energetic) behaviours such as peck to solve the encounter and the hen which became the subordinate readily submitted without any reply. Similar differences in behaviours were observed in mouse. This change in behaviour was suggested to result from learning to avoid or pacify dominant opponents (Brain and Kamal, 1989; Brain and Parmigiani, 1990). In those ω - ω encounters which resolved, it seemed that unfamiliar individual recovered more rapidly than familiar one. Familiarity with the meeting site is clearly not an advantage in this case and having associated the meeting site with prior defeat is probably the factor that produces the handicap.

TABLE 1**Victory frequency by familiar and unfamiliar hens**

Condition	Familiar	Unfamiliar	Unresolved
	won	won	
α - α	18	16	1
ω - ω	4	12	19

Unexpectedly, there is no real advantage gained by the knowledge of a site itself following 3 h or less of familiarization. These results somewhat contradict previous studies on familiarity with the site done on fish species. These studies determined that familiarity with the site in itself advantages both prior dominant and prior subordinate individuals especially when opponents are of equivalent social experience and can reduce the negative effect of a subordinate experience (Braddock, 1949; Beaugrand and Zayan, 1985).

Martin et al. (ms) also did not find any advantage due to familiarity with the site on the determination of dominance in hens. However, Martin et al. (ms) compared opponents having received divergent social experiences of victory and defeat outside the meeting site, while we used opponents of equivalent

experience (i.e. two α or two ω , one of which had a previous experience in the meeting site), their results clearly showed that 2 h familiarity *per se* is not an advantage.

The disadvantage incurred to subordinate individuals having previously lost in the same site may be due to the fact that losers associate more rapidly the site with the stressful effect of losing or being dominated. The observation that only the subordinate individual seemed to be affected may suggest an asymmetry in the learning process related to locus associated experience. For example, it is known that in taste aversion learning one trial is sufficient when animals are biologically prepared to make the associations (Garcia et al. 1973). Positive reinforcement is also known to be generally less efficient during conditioning than punitive reinforcement. In this study the effect of learning may be confounded with that of familiarity with the site because we did not evaluate the unique effect of this factor on hens independently of familiarity. Further studies are required to precisely distinguish between the effects of familiarity from that of learning in the prior residence situation.

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