Evolutionary perspective

Neophobia and dietary conservatism: two distinct processes?

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Abstract. Birds show distinct hesitation when approaching novel food and this has been termed ‘neophobia’. In laboratory-held birds like domestic chicks this effect lasts for a matter of a few minutes at most, but hesitant attack of novel foods can last for weeks or even months in wild birds. This effect, called ‘dietary conservatism’, seems to be a different type of learning process from neophobia as first described and has hitherto been largely overlooked. This paper presents some evidence for the view that the processes may be fundamentally different. We outline results from laboratory chicks that show neophobia to be easily deactivated by experience, which renders it unlikely to be an important force in wild birds. We also report evidence that the process of incorporation of novel food into the diet is not a simple one-stage process but includes at least four steps of assessment. The paper concludes with an outline of the importance of dietary conservatism in our understanding of the evolution of aposematism and the workings of mimicry.

Key words: aposematism, avian predation, chicks, diet, food novelty, mimicry

Background

When a bird encounters a novel prey item, even if it is perfectly palatable, it will hesitate to attack the prey, eating instead any familiar prey which is available. If the novel prey is presented without familiar food being available, the bird may go on to eat the prey after this hesitation. Such behaviour is termed ‘neophobia’ (Barnett, 1958) and is also found in mammals where it is referred to as ‘hyponeophagia’ when referring to fear of novel foods, and ‘neophobia’ when referring to fear of food in a new context (Brigham and Sibley, 1999). There have been a large number of studies of the effects of food novelty on feeding, most conducted in the laboratory and usually with rats (Rattus norvegicus) (Honey, 1990; Galef, 1993) or domestic chicks (Gallus gallus domesticus) (Shettleworth, 1972; Murphy, 1977; Roper, 1993). In any case where hesitancy to eat was recorded, it was attributed to neophobia and was reported as a relatively short-lived effect, lasting a matter of minutes. In contrast, a study of laboratory held canaries (Serinus canaria) (Doherty and Cowie, 1994)
showed that early experience with one seed type caused the birds to select that seed type preferentially even after 15 weeks' experience of 4 seed types. In a series of studies conducted in the wild, blackbirds (*Turdus merula*) and robins (*Erithacus rubecula*) were offered pastry of both familiar and novel colours. These birds showed very long hesitancies to attack the novel food, lasting for up to 3 months of daily trials (Marples *et al.*, 1998). This much longer avoidance was called 'dietary conservatism', but until the present paper no attempt has been made to assess evidence for or against a mechanistic distinction between these two processes. This paper provides preliminary evidence that dietary conservatism may be a distinctly different process from neophobia with relation to the time scales involved, the ease of suppression of the trait, and the complexity of its manifestation. The paper also highlights areas where further work is needed to distinguish these two processes.

**Time scales**

If domestic chicks held in the laboratory are allowed to become familiar with one colour of food or water, they will eat or drink that colour much sooner than chicks offered unfamiliar food or water (Bryan Jones, 1986; Marples and Roper, 1996). The duration of this effect varied with strain and sex of the chicks used, but only by about 3 min (Bryan Jones, 1986). When chicks were left undisturbed for 20 min trials a mixed-sex group of the more neophobic strain ate unfamiliar blue food within 10 min (560.3 ± 82.5 s; mean ± SE; *n* = 35) (Bryan Jones, 1986). Older laboratory held chickens, tested at 22 weeks of age with novel blue food showed a similar or slightly lesser neophobic response, eating the food within 7 min (397.6 ± 85.8 s; *n* = 25) (Bryan Jones and Andrew, 1992). Thus chickens appear to keep this short neophobic response into later life. These experimental designs, and those of other experiments referred to below are summarised in Table 1.

When the same type of experiment was carried out using laboratory bred adult zebra finches (*Taeniopygia guttata*) the latency to eat the novel food was far longer, lasting more than 2 h; on average, the birds did not eat the food for 127 min (7633 ± 1571.5 s) (Kelly and Marples, unpublished data). Laboratory bred quail (*Coturnix coturnix japonicus*) showed attack latencies with a mean of 45 min (Marples and Brakefield, 1995). This extended avoidance compared with chickens seems to be even more pronounced in a number of species living in the wild (pers. obs.) but data only currently exist for two species, blackbirds and robins (Table 1, studies F to I). If wild blackbirds or robins are offered a choice between novel and familiar colours of the same food, both presented together, they will usually eat the familiar food and avoid the novel coloured food for several weeks, although a few individuals will