Chapter 10

White as a Visual Signal

Concerning defensive signaling by white marking, two evolutionary issues should be specifically mentioned: first, the significance of white marking in contrast to colorful marking and second, the probable convergence of this character as expressed by geography and taxonomy. When a certain herbivore is color-blind to a certain sector of the spectrum or is color-blind altogether; or when illumination is not strong or it has an altered color temperature for some meteorological, ecological, or daytime related reason, then white marking increases the possibility that a signal will still be visible. As will be discussed below in several chapters, defensive white marking seems to be common in many plant species originating in various taxa, continents, ecologies, life forms and in many plant organs (see Lev-Yadun 2001, 2003a, 2014a, b, c, d).

White variegation has been proposed to have several functions that can compensate for the assumed or sometimes proven reduced photosynthetic ability of white tissues (Cahn and Harper 1976; Givnish 1990; Allen and Knill 1991; Lev-Yadun 2001, 2003a, 2006a, 2009a, b, c, 2013a, 2014a, b, c, d). However, in many species, white variegation is the result of air spaces formed by lack of adhesion between the epidermis and the photosynthetic parenchyma (Hara 1957; Scarchuk and Lent 1965; Tsukaya et al. 2004), a type of coloration probably not associated with a loss of photosynthetic capacity (Konoplyova et al. 2008). Several studies suggested or even showed in experiments and field work that white variegation or white pigmentation confirms some defense from herbivory (e.g., Cahn and Harper 1976; Wiens 1978; Shifriss 1981; Niemelä et al. 1984; Smith 1986; Givnish 1990; Agrawal and Spiller 2004; Lev-Yadun 2001, 2003a, 2006a, b, 2013a, 2014a, b, c, d; Lee 2007; Campitelli et al. 2008; Soltan et al. 2009; La Rocca et al. 2014), but the exact mechanisms by which it operates as defense from herbivory are only partly understood.