



Fig. 1. *Pieris rapae* (female) (Yoshida, 2002). The distance between the apical tips of the right and left forewings about 4.7 cm.

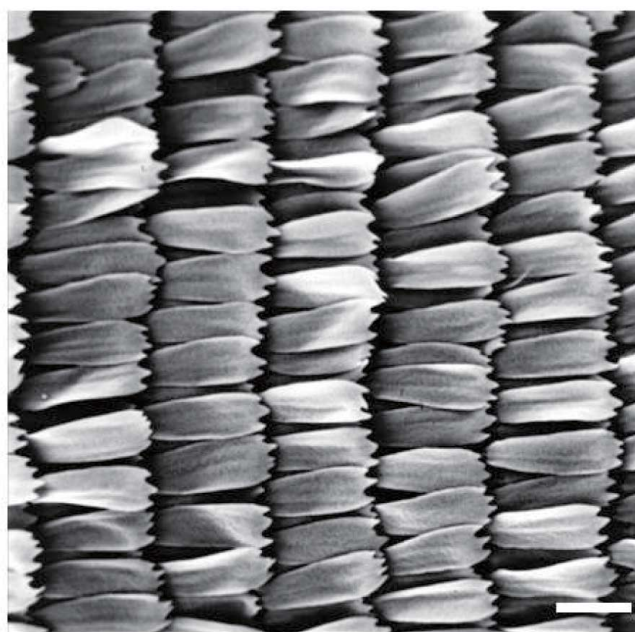


Fig. 2. Scanning electron micrograph of scales in the right wing of *Pieris* (female) (Yoshida and Aoki, 1989). Distal is to the right. This direction is the same as in Figs. 3–5 and 7.

fly, *Morpho didius*, is modified through the layered structure composed of cover and basal scales; the cover scales diffuse the structural blue color. The *Morpho* wing presents the blue or purple color depending on the vision angle, and they indicated that the cover scales contribute to making the blue color region more widely visible. Furthermore, the basal scales absorb the transmitted light to emphasize the blue color of the cover scales.

Yoshida (1992) proposed another role of the layered structure composed of cover and basal scales, taking the scale-wing attachment force into account. Rubbing the wing surface moderately with a piece of sticky tape, cover scales were easily removed and basal ones were exposed (Fig. 3B). The exposed basal scales could not so easily removed as cover scales, which indicates that basal scales are

attached to the wing more firmly than cover scales.

It is indicated that the scale-detaching is responsible for protecting the lepidopterans from being stuck to the spider web (Eisner *et al.*, 1964); the lepidopteran eludes out of the spider web by leaving only its scales on it as if it took off its “clothes”. Thus, the scale-detaching contributes to the lepidopteran life. On the other hand, it appears that the scale-detaching may not be beneficial to it, since the scales have a number of functions which also contribute to it. It seems that the scale-detaching may give the two apparently inconsistent effects on the lepidopteran life. It is possible that the layered structure composed of the two kinds of scales may solve this apparent inconsistency of the scale-detaching effects, as described below. In eluding out of the spider web, it is assumed that most of the detached scales may be the