The Light Resistance of the Flavones and the Flavonols

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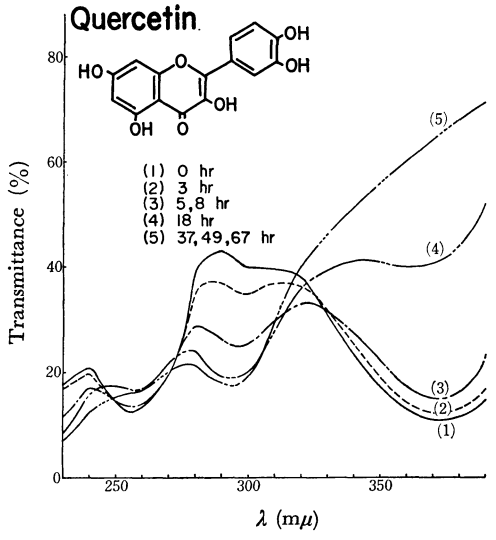
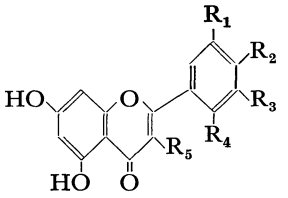
(Received May 21, 1971)

The plants of *Reseda luteola* (luteolin), *Arthraxon hispidus* (luteolin, arthraxin),[1-3] *Miscanthus tinctorius* (luteolin, arthraxin),[3] *Miscanthus sinensis* (tricin),[3] *Phragmites communis* (tricin),[3] *Allium Cepa* (quercetin), *Myrica rubra* (myricetin), *Sophora japonica* (quercetin), and *Morus bombycis* (morin) have traditionally been used as sources of a natural flavonoid dyestuff, the constituents of which are shown in the respective parentheses above.

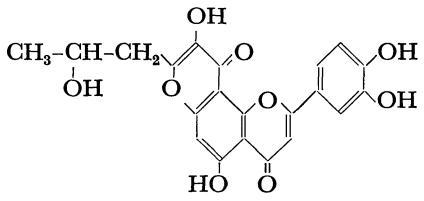
Cloth dyed with *Reseda luteola*, *Arthraxon hispidus*, and *Miscanthus tinctorius* has been said to show a high resistance to the light. However, the causes of this have been unknown. The photooxygenation of 3-hydroxyflavones[4] and the photooxidative cyclization of the quercetin derivatives[5] have recently been reported. Since these results seem to suggest that the molecular structure of flavones influences the resistance to the light, the light resistances have been examined by mean of the UV spectra on the following flavones: quercetin (**1**), morin (**2**), arthraxin (**3**), luteolin (**4**), 8-acetyl-5,7-dihydroxy-3′,4′-dimethoxyflavone (**5**),[1] and tricin (**6**). Because of the similarity in the molecular structures of these substances, their molecular extinction coefficients will be considered to be approximately equal.

The ethanol solution of the sample was irradiated with a 200-W high pressure mercury lamp through a Pyrex, water-cooled jacket under bubbling air. The UV spectrum of an aliquot's portion was then recorded at intervals of 3, 5, 8, 18, 37, 49, and 67 hr. The





1 $R_1,R_2,R_5=OH$ $R_3,R_4=H$
2 $R_2,R_4,R_5=OH$ $R_1,R_3=H$
4 $R_1,R_2=OH$ $R_3,R_4,R_5=H$
6 $R_2=OH$ $R_1,R_3=OMe$ $R_4,R_5=H$



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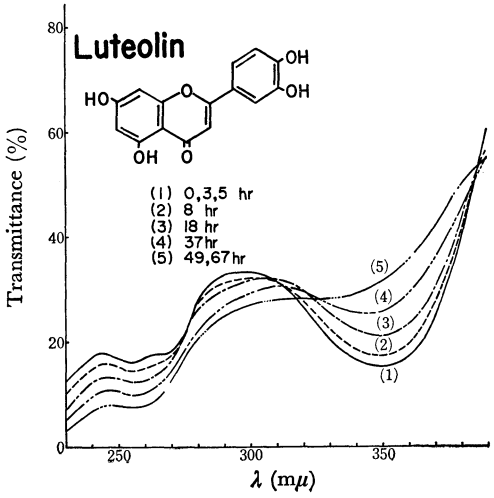
resistance to the light was measured in terms of the time required for the disappearance of Band 1 with the high absorption intensity in the 320—380 nm-region.

As a result, Band 1 of the UV spectra of **1** and **2** disappeared within 18 to 37 hr, whereas the bands of **4**, **5**, and **6** did so only after 67 hr. Among the bands of **3**, **4**, **5**, and **6**, the band of **3** disappeared in the shortest time. This result seems to indicate that the hydroxyheterocyclic ring attached to the flavone nucleus of **3** is easily decomposed by irradiation, like the pyrone ring of flavonols.

It is thus clear that flavones, in contrast with 3-hydroxyflavones, show a high power of resistance to the light when air is bubbled into its ethanol solution. This agrees with the fact that the dyestuff materials in *Reseda luteola*, *Arthraxon hispidus*, and *Miscanthus tinctorius* are superior to those in the other grasses in point of the resistance to the light.



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