Chapter 8

Flavone and Flavonol Glycosides

JEFFREY B. HARBORNE and CHRISTINE A. WILLIAMS

8.1 Introduction

8.2 Separation and purification

8.2.1 Paper chromatography
8.2.2 Thin layer chromatography
8.2.3 Column chromatography
8.2.4 Other procedures

8.3 Identification

8.3.1 General
8.3.2 \( R_f \) determination
8.3.3 Hydrolytic procedures
8.3.4 Spectral methods

8.4 The sugars of flavone and flavonol glycosides

8.4.1 Monosaccharides
8.4.2 Disaccharides
8.4.3 Trisaccharides
8.4.4 Acylated glycosides
8.4.5 Potassium bisulphate salts

8.5 The known flavone glycosides

8.5.1 Apigenin glycosides
8.5.2 Luteolin glycosides
8.5.3 Other flavone glycosides

8.6 The known flavonol glycosides

8.6.1 Kaempferol glycosides
8.6.2 Quercetin glycosides
8.6.3 Other flavonol glycosides

8.7 Distribution patterns
8.1 Introduction

A vast range of different flavone and flavonol glycosides have now been reported in plants. For quercetin, the most common flavonol aglycone, over seventy glycosidic combinations have been fully characterized and many more have been partly analysed. Quercetin must thus be unique among all the many known natural plant constituents in occurring in quite so many different combined forms. Almost as many glycosides have been described in the case of the other two common flavonols, kaempferol and myricetin, and there are also numerous derivatives of the two common flavones, apigenin and luteolin. Adding in the known glycosides of the rarer flavonols and flavones brings the total to nearly 400.

Structural variation among these flavonoid glycosides is considerable, both in the nature of the sugar residue and the position of attachment through hydroxyl groups to the flavone or flavonol nucleus. Examples of glycosidic structures, illustrating some of the possible variation, are shown in Fig. 8.1. The complications of studying these glycosides can be considerable particularly since in many plant species, complex mixtures of related glycosides are often encountered, the particular mixture varying according to the plant organ examined. It is also common experience to find that these glycosides occur in vastly differing concentrations, from as much as 15–20% of the plant dry weight to as little as 0.001%. While the major components may be easily characterized, the minor constituents often have to be ignored because there is insufficient material for full identification.

In spite of all the work that has been carried out to date, we are only just beginning to appreciate the biosynthetic potential of plants to produce such complex mixtures of glycosides and to understand the interaction between flavones and flavonols and carbohydrate metabolism. While these glycosides are very valuable as taxonomic markers in plants (see Chapter 19), we are far from a full understanding of their function and overall significance in the plant's economy.

It is our intention in this chapter to provide an outline of present knowledge about the flavone and flavonol glycosides with the emphasis on the developments of the last ten years. Earlier accounts which should be consulted for historical and other aspects not covered here, are those of Karrer (1958), Geissman (1962) and Harborne (1964a, 1967d). While it would be desirable to present