

External Flavonoids of *Ocotillo* (*Fouquieria splendens*)

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Z. Naturforsch. **49c**, 689–690 (1994);
received March 25, 1994

Fouquieria splendens, Fouquieriaceae,
Lipophilic Exudate, Flavonoid Aglycones

Leaves and stems of *Fouquieria splendens* were found to accumulate flavonoid aglycones on their surfaces. Three flavones and five flavonols have been identified.

vonoids. The resinous material obtained on evaporation of the solvent (ca. 600 mg) was dissolved in boiling methanol, cooled to room temperature, then to -10°C for 15 min and centrifuged, thereby eliminating waxy and fatty material. The supernatant solution was then directly used for thin layer chromatographic studies. Direct comparisons with authentic samples of flavonoid aglycones were done on polyamide DC-11 with the solvents toluene–dioxane–methanol 8:1:1 and toluene–methyl ethyl ketone–methanol 12:5:3 and on silica with the solvents toluene–methyl ethyl ketone 9:1 and toluene–dioxane–glacial acetic acid 18:5:1. Chromatograms were viewed under UV before and after spraying with Naturstoffreagenz A.

Introduction

Fouquieria splendens Engelm. is perhaps the best known member of the Fouquieriaceae, the candlewood family, which contains eleven species in one to two genera (Henrickson, 1972). It is distributed from California to Texas and from northwestern Mexico eastward to Tamaulipas and Hidalgo. It forms shrubs with slender spiny branches arranged in fan-shaped clusters or inverted conical masses. The brilliant red flowers appear at or near the end of the branches. Flowering in April or May, ocotillo or coachwhip is a beautiful and very characteristic plant of rocky, exposed slopes or gravelly or sandy plains in the Mojave, Sonoran and Chihuahuan deserts (Henrickson, 1972; Benson and Darrow, 1981).

Materials and Methods

Leaves and stem sections of flowering *Fouquieria splendens* ssp. *splendens* were collected in May, 1990 in the Mohave Desert in Mohave Co., Arizona (Interstate 40, at exit #20). A voucher (G. Yatskievych 90-62, E. Wollenweber) is accessioned at the Missouri Botanical Garden Herbarium (MO). Air-dried leaves and stem pieces were rinsed with acetone to dissolve the exudate fla-

Results and Discussion

During a collection trip in California in search of plants that accumulate free flavonoid aglycones on their leaf and stem surfaces, we collected a sample of stem sections and leaves of ocotillo, although no exudate formation was noticed in the field. The plants do produce a waxy layer of varying density. The air-dried parts were separately rinsed with acetone to dissolve any externally deposited lipophilic material. We were surprised to observe that stem pieces as well as leaves yielded yellow solutions. Thin layer chromatographic control revealed that they exhibited, indeed, several flavonoid aglycones. Since the flavonoid pattern appeared to be the same in both portions, the solutions were combined and “defatted” to allow for more detailed analysis.

Direct chromatographic comparisons with authentic flavonoid samples enabled us to identify the following compounds: the flavones apigenin and apigenin 4'-methyl ether (acacetin), luteolin and luteolin-3'-methyl ether (chrysoeriol); the flavonols kaempferol and its -3-methyl (isokaempferid) and -3,4'-dimethyl ether (ermanin), quercetin and its 3-methyl and 3,3'-dimethyl ether. Among these, apigenin and ermanin appear to be the major components.

The flavones and flavonols found in this study are by no means rare natural products. It is also well known by now that flavonoid aglycones are

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excreted and accumulated externally, on leaf and stem surfaces, by members of many families of Angiosperms (Wollenweber, 1990). To our knowledge this is the first time, however, that they have been encountered on a member of the Fouquieriaceae. Obviously the phenomenon of flavonoid aglycone excretion is more widespread than had been thought previously. It may be assumed that the number of families concerned will still increase, provided that more attention is given to

their localization whenever flavonoid aglycones are found in the free state (Wollenweber, 1993). Further studies involving other species of Fouquieriaceae would also be productive.

Acknowledgements

Thanks are due to the Deutsche Forschungsgemeinschaft for financial support (to E. W.) of a collecting trip and to Mrs. Marion Dörr for technical assistance.

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