1 General Account

1.1 Distribution and Importance

*Polygonum hydropiper* L. (family Polygonaceae) is a member of a genus of some 175 species. It is a semi-erect (25–75 cm) annual herb with a branched stem and lance-shaped leaves, carrying its greenish-pink flowers in slender racemes (Fig. 1). The species is widespread in most parts of Europe, temperate Asia, and North America, and it also occurs at scattered sites in North Africa. Across its main range it is abundant in the verges of ponds and ditches and on waterlogged grasslands and water meadows. *P. hydropiper* is not grown commercially but has found an exceptionally impressive range of uses in folk medicine and also as a culinary herb, and this has led to the adoption of a rich variety of apt local names, e.g. fireweed, arsemart and smartweed are examples of some 20 English regional names in addition to the accepted vernacular name of “water pepper”. The flower heads have little odour but all the aerial parts have a bitter acrid taste and contain vesicant compounds that blister the skin upon repeated handling (Clapham et al. 1952).

Medicinal use of *P. hydropiper* goes back to Dioscorides (ca. 60 A.D.) and tinctures of foliage are used as diuretics, diaphoretics, and to arrest gynecological bleeding (Wisniewski and Szlaski 1970). Water effusions are astringent and anti-inflammatory and have been claimed efficacious for colds, coughs, dysentery, gout, sores and ulcers, toothache, dropsy, menstrual pains, and hemorrhoids. Foliage can be applied to arrest bleeding or be secreted in beds to kill fleas, cf. German synonyms *Flohkraut* and *Flohpeffer* (Grieve 1931; Grigson 1975; Launert 1981). Linneaus recorded that the herb yielded a yellow dye with an alum mordant. The peppery taste of the foliage has led to widespread culinary use in the Far East, in particular as a garnish for fish dishes.

These varied biological effects, if not anecdotal, must be a consequence of the secondary metabolism of the herb. The essential oil from foliage (ca. 0.43% dry wt.) contains monoterpenoids with a variety of skeletons, e.g. 1,4-cineole, car-3-ene, α and β-pinenes, fenchone, borneol, camphor, linaloyl acetate etc., but is otherwise unexceptional (Yankov and Damyanova 1969). More noteworthy is the sesquiterpenoid component of the flower heads. The main compound (ca. 0.05% wet wt.) is...
Fig. 1. Polygonum hydropiper L. (Courtesy of Dr. G.S. Morris, University College London)

(−)-polygodial (Fig. 2, 1) accompanied by its hydroxy-derivative (−)-warburganal (Fig. 2, 2) in small amounts. The former (≡9β-drim-7-en-11, 12-dial) has also been isolated from liverworts and named tadeonal (Barnes and Loder 1962; Fukuyama et al. 1982). Both polygodial and warburganal are responsible for the hot taste of the plant (Kubo and Ganjian 1981; Askawa et al. 1988). Polygodial has been assigned widespread physiological activities. It is a fungicide, and as it acts by damaging cell membranes, it also facilitates the entry of antibiotics and thus is synergistic for them (Kubo and Taniguchi 1988; Taniguchi et al. 1988). It also acts as a mutagen (Sterner et al. 1987); an allergen (Stampf et al. 1982); a plant growth inhibitor, preventing germination of rice at 100 ppm (Asakawa and Takemoto 1979); is moluscidal, piscicidal and phytotoxic (Asakawa et al. 1988); and is a viral-genome inactivator (Tokuda and Matsumoto 1989). Best studied is its antifeedant activity towards aphids (Dawson et al. 1986) and armyworms (Kubo et al. 1976). Thus, leaves of Zea mays dipped into 0.1 ppm solutions of the dialdehyde are uneaten and the insects perish of starvation. Warburganal is also antifungal (Taniguchi et al. 1984) and is an antifeedant for armyworms (Kubo et al. 1976) and aphids (Asakawa et al. 1988). Other drimane derivatives isolated from foliage