Isolation and identification of plant growth inhibitors from buckwheat

°Zahida Iqbal, S. Isojima, A. Noda (Noda Plants Technica) and Y. Fujii (NIAES)

Abstract

Fagopyrum esculentum (buckwheat), a member of the family polygonaceae, is an important forage, grain and cover crop, and has shown strong allelopathic activity in field, green house and laboratory studies. This paper describes the bioassay directed isolation and characterization of allelopathic constituents from *Fagopyrum esculentum* and an examination of their allelopathic potential on lettuce seedlings and some other common weeds.

Methods and Materials

Air-dried arial parts of *Fagopyrum esculentum* (2 kg) were extracted with 80 % aqueous ethanol. The extract was dried to a crude brown gum (166 g), acidified with 10% acetic acid and sequentially partitioned against hexane, chloroform, ethyl acetate and methanol (Fig. 1). The residue of the chloroform soluble fraction was found most active in the bioassay examination (Fig. 2). Therefore it was chromatographed on a column of silica gel (100 g, silica gel C-60, 70-230 mesh, Merck) and eluted with *n*-hexane-chloroform, and methanol. All the fractions obtained thereof were subjected to bioassay study (Fig. 3) and among these, fraction 6 was found highly inhibitory which after repeated chromatography led to the isolation of compounds **1** & **2**.

Results and Discussion

The chloroform soluble part being most inhibitory was subjected to repeated column chromatography and preparative thin layer chromatography to yield two alkaloids **1** as colorless needles (40mg) which was identified as fagomine, and **2** as yellowish white sticky substance (37 mg) which was identified as 2-piperidine methanol by NMR along with two other compounds identified as palmitic acid and abscisic acid. The ¹H NMR and ¹³C NMR data of **1** & **2** were consistent with the published values.

Compounds **1** & **2** were found strongly inhibitory and inhibited the root growth of lettuce seedlings in a dose dependent fashion. The root and shoot growth was almost diminished at 500 ppm. The 50 % growth inhibition was observed at a 10 ppm (Fig. 4 & 5). Growth inhibition effects of these compounds were also determined on various weeds and were found selectively inhibitory (Fig. 6 & 7). This study demonstrates that buckwheat is selectively phytotoxic to weeds and can be used as ground cover crop. Further studies are in process to determine other constituents of buckwheat responsible for its allelopathic activity.

Fig. 1

Fig. 2

Fig.3

Fig. 4

Fig.5

Fig.6

Fig.7