

学位論文要旨

Allelopathic Potential of Wild and Cultivated Plants in Turkey and Identification of Allelochemicals

トルコの野生および栽培植物のアレロパシー活性の検索と

アレロケミカルの同定

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Allelopathy is a biological phenomenon that can be observed in many plants that release chemicals into the surrounding environment either from their aerial or underground parts in the form of root exudation, leaching by dews and rains, and volatilization or decaying plant tissue. In this process, allelochemicals can act as natural weed inhibitors upon their release from various donor plant species. The utilization of these allelochemicals and allelopathic plants can be further explored to reduce the dependence on synthetic herbicides. The screening of a large number of plants by bioassay might be the first significant step in the investigation of related allelochemicals and their application in weed management. This research focused on medicinal plants from Turkey, which is one of the countries with the richest plant diversity in the Mediterranean region. Therefore, the objectives of this study were i) to evaluate the allelopathic activity of a large number of plants from Turkey for the first time and to determine the species with significant plant growth inhibitory potentials by bioassay and ii) to identify allelochemicals which are responsible for the plant growth inhibitory activity of candidate species.

The sandwich method was used to evaluate the potential allelopathy of 126 medicinal plants belonging to 55 families. The results of lettuce radicle and hypocotyl growth for 10 and 50 mg sample treatment conformed to normal distribution. Significant inhibition on lettuce radicle elongation with 10 mg sample was observed in 40 species, out of which 27 species showed over 50% inhibitory activity. The results suggested that these species could contain potential inhibitory compounds against lettuce radicle or hypocotyl growth. The calyxes of *Hibiscus sabdariffa* (3.2% of control) and the seeds of *Prunus dulcis* (5.7% of control) showed the most potent growth

inhibitory activity on lettuce radicle elongation. The potential plant growth inhibitory effects of these plants, together with the fruits of *Rhus coriaria* and seeds of *Prunus mahaleb*, have been reported in this study for the first time.

Dish Pack Method was used to evaluate volatile allelopathy of supplied 68 species belonging to 43 families. The results of lettuce radicle and hypocotyl growth at 41 mm distance from the centre of source well filled 200 mg sample conformed to normal distribution. Significant inhibition on lettuce radicle elongation at 41 mm distance from the centre of source well was observed in 14 species, out of which 12 species showed over 50% inhibitory activity on the lettuce seedling radicle growth. Results suggest that these species were found containing with volatile potential inhibitory compounds against lettuce radicle growth. *Centaurium erythraea* Rafn and *H. sabdariffa* exhibited the strongest growth inhibitory activity, with radicle elongation of 0% and 1% respectively. Here volatile growth inhibitory effect of theirs and many other samples *Salvia officinalis*, *Lavendula stoechas*, *Valeriana officinalis*, *Melissa officinalis*, *Prunus mahaleb* have been reported for the first time.

All these plants are medicinal, and the results hereby presented provide essential information about the allelopathic effects of medicinal plants from Turkey.

The phytotoxicity of *H. sabdariffa* was further investigated since the plant showed the highest potential plant growth inhibitory activity by Sandwich bioassay and the second highest volatile potential plant growth inhibitory activity by Dish Pack bioassay against lettuce. Hydroxycitric acid and hydroxycitric acid lactone were determined 9.15% and 16.5% of dry weight of *H. sabdariffa* calyx respectively. Plant growth inhibitory activity as the specific activity (EC₅₀) of *H. sabdariffa* calyx crude extract, pure hydroxycitric acid, and hydroxycitric acid lactone were about 300 mg/L, 1300 mg/L, and 40 mg/L for radicle, respectively. The high concentration and strong inhibitory effect of hydroxy citric acid lactone could explain the inhibitory activity of *H. sabdariffa* calyx extract. Hydroxy citric acid lactone was confirmed to be the principal allelochemical involved in the inhibitory activity of *H. sabdariffa* calyx. This is the first report of hydroxycitric acid lactone as a plant growth inhibitor from *H. sabdariffa* calyxes.