18 gr or 32 g/6" pots as topdress for liverwort control

Section IV
Biological and Cultural Control

Limnanthes (Meadowfoam) Seedmeal As a Potential Biocide

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Our objective is to determine if *Limnanthes* plant residues can be utilized as a biocide to control various pests in agricultural and horticultural production systems. *Limnanthes* plant residues can include defatted seedmeal used as a mulch/top-dressing or incorporated, a cover crop, a green manure, or used in combination with other plant residues and/or biocides.

Meadowfoam (*Limnanthes alba* Hartweg ex. Benth) is a commercial oilseed crop produced in the Willamette Valley of Oregon for its unique fatty acids which are used in the manufacture of lubricants, cosmetics and plastics (Kleiman and Princen, 1991; Savonen, 1997). Uses for the seedmeal remaining after oil extraction need to be identified. Various species of *Limnanthes* are also used as ornamental crops, such as *Limnanthes douglasii.*

Previous studies have shown that *Limnanthes* seeds contain glucosinolate glucolimnanthin (Bartelt and Mikolajczak, 1989). Glucosinolate degradation products include isothiocyanates, nitriles and thiocyanates (Van Etten and Tookey, 1983), some of which have been shown to be potent biocides (Brown et al., 1991; Gamliel and Stapleton, 1993; Delaquis and Mazza, 1995). Degradation products of glucolimnanthin have been shown to be highly toxic to several insect larvae (Bartelt and Mikolajczak, 1989). Examination of seeds of the genus *Limnanthes* by Sarker *et al*. (1996) demonstrates the presence of moderate to high levels of phytoecdysteroids. Experiments are currently underway at North Willamette Research & Extension Center (NWREC) to examine the effects of *L.* seedmeal on Black Vine weevils in nursery crops.

Vaughn *et al*. (1996) studied meadowfoam breakdown products with potential inhibitory effects on weed growth, identifying 3-methoxyphenyl acetonitrile as the probable active ingredient inhibiting radicle elongation of velvetleaf (Abutilon theophrasti Medicus) and wheat (Triticus aestivum L. 'Cardinal'). Experiments conducted in 1998 at NWREC and at "on-site" commercial nurseries confirm the phytotoxic effects of *L.* seedmeal when used as a top-dressing application and planting media incorporation in ornamental taxa. Species of ornamnetals screened included: *Acer, Agrapanthus, Artemisia, Buxus, Carex, Cornus, Dianthus, Dicentra, Dryopteris, Euonymus, Forsythia, Ginko, Heuchera, Hosta, Ilex,*

phyto-active steroid act as an insect growth regulator

Juniperus, Nicotiana, Picea, Potentilla, Prunus, Rhododendron, Rosa, Salvia, Tagetes, Taxus, Thuja, Tiarella, Viburnum, Vinca, Yucca, and *Zinnia.* Phytotoxicity symptoms (stunted growth, chlorosis, necrotic tissue, death) occurred in all treatments of *Cornus*, and at higher treatment rates (>25% by volume) when incorporated into media of *Euonymous, Ginko, Juniperus, Potentilla, Rhododendron, Taxus,* and *Thuja*. However, top-dressing with seedmeal resulted in less phytotoxicity symptoms exhibited. Also, low rates of seedmeal (5-10% by volume top-dressed or incorporated) resulted in significantly greater plant height compared to controls. This is probably due to a low C:N ratio and additional mineral supplementation as revealed by mineral analysis of the seedmeal. A correlation between treatment and weeds was observed with seedmeal treatments containing fewer weeds.

Effects of *L.* seedmeal on vegetable seedlings was also conducted in 1998 at a commercial seedling production nursery (NW Transplants, Mollala, Oregon). Vegetables examined included broccoli, cabbage, celery, leek, lettuce, pepper, and squash. Treatments included a control, 2%, 7% and 20% incorporation and a 30% by volume top-dressing in 200 count seedling plug trays. Results included inhibition of seedling emergence in all treatments of seedmeal and phytotoxic symptoms including a-gravitropic response in treatments containing 7% and 20% incorporations and 30% top-dressings. The highest degree of phytotoxicity was recorded in the 20% incorporation treatments. Treatments containing 2% and 7% seedmeal incorporations resulted in significantly greater color and vigor in pepper, celery, and squash when compared to controls.

Glucosinolate products have been shown to influence bacterial and fungal populations (Brown and Morra, 1997). Studies of pathogen inhibition by glucosinolate-derived allelochemicals include inhibiting the growth of *Rhizoctonia solani* (Lewis and Papavizas, 1974), *Pythium ultimum* and *Sclerotium rolfsii* (Gamliel and Stapleton, 1993), *Fusarium oxysporum* (Horricks, 1969), and *Aphanomyces* root rot (Papavizas, 1966). Our preliminary data analysis indicates that *L.* seedmeal may be useful for controlling liverwort, an unsightly bryophyte fungi commonly found in nursery crops. Experiments are planned for 1999 that will determine the compatibility of *Limnanthes* plant residues with other beneficial microorganisms including mycorrhizal fungi. If compatible, the combination would make a very useful biorational tool for the control of weeds, soilborne diseases and insects. The use of plant-produced allelochemicals in agricultural practices could minimize synthetic pesticide use, reduce the associated potential for environmental contamination, and contribute to a sustainable agricultural system (Brown and Morra, 1997).

Clubroot, a generic name describing the disease caused by *Plasmodiophora brassicae* Wor., a pathogenic fungi, has been a serious problem in cruciferous crops for over 250 years. The first historic mention of this disease dates back to 1736 (Wellman, 1930). At present, this disease is widespread and occurs wherever crucifers are cultivated including the Pacific Northwest. Breeding resistant crops is promising but adoption of this technology is slow. Many soil sterilants and fungicides offer some control but marginal values in the crops usually do not justify their use. We recently examined the effects of *Limnanthes* seedmeal on *Plasmodiophora brassicae* Wor. in Chinese mustard and cauliflower. This experiment was also conducted at an "on-site" commercial nursery (NW Transplants in Mollala, Oregon, 1998). The experiment included two controls (negative and positive for pathogen), seedmeal incorporation treatments of 5%, 10%, and 20% by volume, a 10% seedmeal plus an 8 ounce drench (per pot) of 3% H_2O_2 . Another treatment consisted of a 10% incorporation of meadowfoam screenings. Pots were hand sown with susceptible varieties of Chinese mustard (*Brassica chinensis* (un-named line)), and cauliflower (*Brassica oleracea* var. *botrytis* 'Snowball Y Improved') on intervals of 7 days (7, 14, 21,and 28 days). All treatments with meadowfoam plant residue incorporations (seedmeal and screenings) resulted in complete control of clubbing compared to positive controls which contained 70-90% clubbing and severity ranging from <25% of root system clubbed to >50% of root system clubbed including rotting of main tap root. Both plant species exhibited clubbing in positive controls with Chinese mustard containing a higher degree of clubbing. There was significant difference in plant height between controls and treatments. Treatments containing 20% seedmeal and 10% seedmeal with 3% H_2O_2 drench resulted in plants exhibiting phytotoxic symptoms (germination inhibition, a-gravitropic response, stunted growth, chlorosis, and death). These symptoms varied to a lesser degree as seeds were sown later (significantly greater phytotoxic effects when seeds were sown at 7 days compared to seeds sown at 28 days after initial media preparation). However, treatments with 5% and 10% seedmeal and 10% screenings resulted similar to greater plant height compared to controls. Determination of asymptotic presence of pathogen on treated plants using microscopy was inconclusive.

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Section IV
Biological and Cultural Control

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