Novel Pasture Legumes in Australia –The Case of Biserrula (Biserrulla pelecinus L.) and Metabolites Associated with Livestock Photosensitiization

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Abstract

Biserrula and French serradella are annual legumes native to the southern Mediterranean. Serradella was widely cultivated throughout France and temperate Europe in the Middle Ages while biserrula was found more sporadically in mixed legume stands. These legumes were rediscovered in the 1990's through the efforts of Australian breeders and are well adapted to diverse Australian conditions. With ample rainfall, they can rapidly establish dense stands, are deep rooted and regenerate due to the production of hard seeds which germinate the next winter following false breaks (summer rainfall events). Both legumes are drought tolerant and adapted to acidic soils. Despite proving to be a valuable addition to the limited pasture toolbox, producers in NSW and WA have identified key factors limiting uptake. In the case of French serradella, intolerance to heavy weed infestation and high soil Mg resulted in reduced stands. Livestock have performed well on both forages as protein content ranges from 12 to 25%, and pastures offer considerable feed until early summer. Biserrula established rapidly and densely and was often weed suppressive. Despite the competitive growth habit, high protein content and low methane generation, the uptake of biserrula in southern Australia has been severely limited by the development of photosensitization in grazing livestock. The pathogenesis of biserrula photosensitization and associated metabolite(s) have been the focus of our recent experimentation. All commercial cultivars of biserrula caused primary photosensitization. MTT bioassays with cell suspension cultures have shown that shoot tissue extracts exhibited no photoactivity following forage senescence or drying. Bioactivity-guided metabolic profiling using UPLC/MS-QToF followed by separation of crude extracts using silica gel flash column chromatography and HPLC resulted in identification of multiple metabolites associated with photosensitization. The process involved in identification of bioactive phototoxic secondary metabolites will be further described. Strategies to limit photosensitivity to grazing livestock were also developed.

Keywords: hard, seeded annual legumes, biserrula, serradella, photosensitization, secondary metabolites, MTT bioassay, metabolomics

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