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Abstract

Antioxidative and Anti-*Borrelia* Effects of *Plantago* Species †

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Borrelia burgdorferi sensu lato bacteria are the causative agent of Lyme disease, Europe's most common vector-borne disease. In Estonia, the number of ticks carrying pathogenic bacteria and the case numbers of the illness are rapidly rising [1]. The infection can affect multiple organ systems and withstand several rounds of antibiotic treatment [2]. Therefore, novel treatment options are needed to combat the persister forms of the bacteria responsible for the chronic illness [3]. The screening of natural resources has shown promise in helping discover lead compounds with distinct anti-*Borrelia* activity for future therapeutic approaches. The antioxidative and antibacterial properties of several plants found in Estonia have been demonstrated by our group. This presentation discusses the chemical characterisation and anti-*Borrelia* activity determination of *Plantago major* and *Plantago lanceolata*. The plants' main groups of bioactive compounds were quantified by colorimetric tests, total polyphenols by the Folin–Ciocalteu, total flavonoids by the $AlCl_3$, and total iridoids by the Trim–Hill method. The results show that dried aerial parts of *P. major* and *P. lanceolata* contain up to 32.7 and 47.1 mg/g gallic acid equivalents of phenolic compounds, up to 10.0 and 14.4 mg/g quercetin equivalents of flavonoids, and up to 11.4 and 23.4 mg/g asperuloside equivalents of iridoids, respectively. The extracts were chemically characterised using HPLC–DAD–MS/MS. The antioxidative activity of all extracts was evaluated using the $ORAC_{FL}$ method, and found to be up to 12.3 or 14.6 mg/g Trolox equivalents for *P. major* and *P. lanceolata*, respectively. The anti-*Borrelia* activity of the plant extracts was tested on the latent bacterial forms using the SYBR Green I and Propidium Iodide assay. The residual viability of *B. burgdorferi* bacteria after incubation with the plant extracts was as low as 18.7% for *P. major* species, and 23.6% for *P. lanceolata* species. Therefore, as our results demonstrate that both *P. major* and *P. lanceolata* contain considerable amounts of phytochemicals with antioxidant properties and show significant anti-*Borrelia* effects on the latent forms of *B. burgdorferi*, these plants should be considered for further therapeutic research.

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