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## Antioxidant, toxicity, and enzyme-inhibitory potential of *Annona muricata*, *Persea americana* and *Phyllanthus acidus*

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Medicinal plants have been utilized traditionally for treating various ailments. There is a lack of comprehensive scientific validation of their therapeutic properties and safety. This study aims to evaluate the biological activities (antioxidant, enzyme inhibitory, cytotoxic, and phytotoxic) of methanolic extracts from locally (Kandy, Sri Lanka) abundant medicinal plants *Annona muricata* (Soursop), *Persea Americana* (Avocado), and *Phyllanthus acidus* (Star Gooseberry). Plant materials were obtained, dried, powdered, and extracted using methanol. Antioxidant activity was assessed by the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, enzyme inhibitory activity was evaluated against  $\alpha$ -amylase and lipase by spectrophotometric methods, cytotoxicity was evaluated by the brine shrimp lethality assay, and phytotoxicity was evaluated by the lettuce seed germination assay. Data were analyzed using ANOVA and IC<sub>50</sub> values were calculated. *A. muricata* exhibited the highest crude extract yield (17.55 g/100g dry weight) and potent antioxidant activity (IC<sub>50</sub>= 5.61 mg L<sup>-1</sup>), comparable to ascorbic acid (IC<sub>50</sub> 3.46 mg L<sup>-1</sup>). *P. acidus* showed moderate  $\alpha$ -amylase activity (32.83% inhibition at 1000 mg L<sup>-1</sup>) and lipase inhibitory activity (IC<sub>50</sub>= 488.31 mg L<sup>-1</sup>). All extracts displayed potent cytotoxicity in the brine shrimp assay, with *P. americana* (LC<sub>50</sub>= 9.00 mg L<sup>-1</sup>) and *P. acidus* (LC<sub>50</sub>= 21.11 mg L<sup>-1</sup>) showing significant effects comparable to atropine (LC<sub>50</sub>=88.6 mg L<sup>-1</sup>). *P. americana* extract demonstrated weak phytotoxic and allelopathic effects, inhibiting lettuce seed root (IC<sub>50</sub>= 433.60 mg L<sup>-1</sup>) and shoot growth. The findings reveal that *A. muricata* exhibits potent antioxidant and cytotoxic activities, *P. acidus* possesses enzyme-inhibitory properties, and *P. americana* has allelopathic effects. These activities could be attributed to the presence of bioactive compounds like polyketides, phenolics, and flavonoids. Further research is recommended to isolate and characterize the specific bioactive compounds responsible for the observed activities and investigate *in vivo* pharmacokinetics, safety, and efficacy through cell culture models, animal studies, and field trials for potential therapeutic and agricultural applications.

**Keywords:** Allelopathy, bioactive compounds, pharmacology