Put AI-LyD On It! An AI-Driven Systematic Approach to Understanding, Predicting, and Controlling Spotted Lanternfly Proliferation Through Behavioral Analysis

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The spotted lanternfly (SLF), Lycorma delicatula, is an invasive planthopper species that feeds on a wide variety of plant hosts, causing an estimated $3 billion in damages in the United States annually. Despite its spread across 19 US states and other countries, current SLF control efforts face three primary challenges: 1) the “California Paradox”, deviations between predicted and real-world SLF distributions, 2) low accuracy of existing AI-powered detection on wild SLF photographed conditions, and 3) no scalable, cost-effective, and environmentally friendly control solutions exist for mitigating SLF. This research proposes AI-LyD, an AI-driven system integrating SLF behavioral findings to enhance prediction, detection, and elimination strategies. AI-LyD develops an improved MAXENT proliferation prediction model by introducing key environmental factors: SLF responses to inclement weather and freezing period for successful egg hatching. This model accurately resolves past and present SLF distributions, with an AUC of 0.821. AI-LyD also created the first SLF image database, training a robust ML YOLO object-detection model that achieved a mAP50 value of 0.951 and reduced false-positives by 68%. AI-LyD introduces Aquabex, an eco-friendly, < $0.50/unit water moat solution exploiting SLF’s crawling and hydrophobia. AI-LyD connects to citizen science efforts via the Bellbug app, giving users access to macro real-time prediction, detection, and Aquabex deployment modules. AI-LyD is the first system combining key behavioral insights with AI to not only mitigate current infestations, but also proactively prevent future invasions through accurate early-stage prediction and detection.

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