

Bioelectrical signal responses of *Mimosa pudica* L. (Nidikummba) to instant light–dark transitions

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Mimosa pudica L. (Nidikummba) shows highly sensitive electrophysiological responses to environmental stimuli. Consequently, the bioelectrical signals are a promising basis for plant-based ecological sensing and monitoring applications. Thus, this study investigates the plant's electrical activity under instantaneous light-dark transitions (0-1200 lux) in controlled indoor settings. A custom-built data acquisition system using an ESP32 microcontroller and AD620 instrumentation amplifier was used to record millivolt-level electrophysiological signals alongside synchronized environmental sensor data. Experiments were conducted over multiple days in three phases by isolating the effects of key factors: constant illumination with naturally fluctuating climate and periodic light–dark transitions. The recorded signals were processed with digital signal processing techniques, including baseline drift correction, 4th-order Butterworth low-pass filtering, Savitzky–Golay smoothing, and FFT-based noise filtering to enhance signal clarity. Distinct electrical patterns were observed, including rapid action potentials (~15 mV to ~69 mV) triggered by instant light transitions (dark), and then showed variation potentials (~15 mV to ~100 mV) in response to light on condition. These results confirmed that *M. pudica* produces clear, measurable electrical responses to instant light–dark transitions, validating it as a viable living biosensor. The real-world experimental approach underscores the originality of using a plant under natural conditions, and it lays the groundwork for integrating plant bioelectrical signals into future predictive environmental monitoring systems.

Keywords: *Mimosa pudica*, Plant electrophysiology, Bioelectrical signals, Environmental monitoring, Biosensor