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Object Detection Based on Deep Learning Model for Two Stage Tracking with Pest Behavior Patterns in Soybean (*Glycine max* (L.) Merr.).

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[Abstract]

Soybean (*Glycine max* (L.) Merr.) is a representative food resource. To preserve the integrity of soybean, it is necessary to protect soybean yield and seed quality from threats of various pests and diseases.

Riptortus pedestris is a well-known insect pest that causes the greatest loss of soybean yield in South Korea. This pest not only directly reduces yields but also causes disorders and diseases in plant growth. Unfortunately, no resistant soybean resources have been reported. Therefore, it is necessary to identify the distribution and movement of *Riptortus pedestris* at an early stage to reduce the damage caused by insect pests.

Conventionally, the human eye has performed the diagnosis of agronomic traits related to pest outbreaks. However, due to human vision's subjectivity and impermanence, it is time-consuming, requires the assistance of specialists, and is labor-intensive. Therefore, the responses and behavior patterns of *Riptortus pedestris* to the scent of mixture R were visualized with a 3D model through the perspective of artificial intelligence. The movement patterns of *Riptortus pedestris* was analyzed by using time-series image data. In addition, classification was performed through visual analysis based on a deep learning model.

In the object tracking, implemented using the YOLO series model, the path of the movement of pests shows a negative reaction to a mixture R in a video scene. As a result of 3D modeling using the x, y, and z-axis of the tracked objects, 80% of the subjects showed behavioral patterns consistent with the treatment of mixture R.

In addition, these studies are being conducted in the soybean field and it will be possible to preserve the yield of soybeans through the application of a pest control platform to the early stage of soybeans.

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