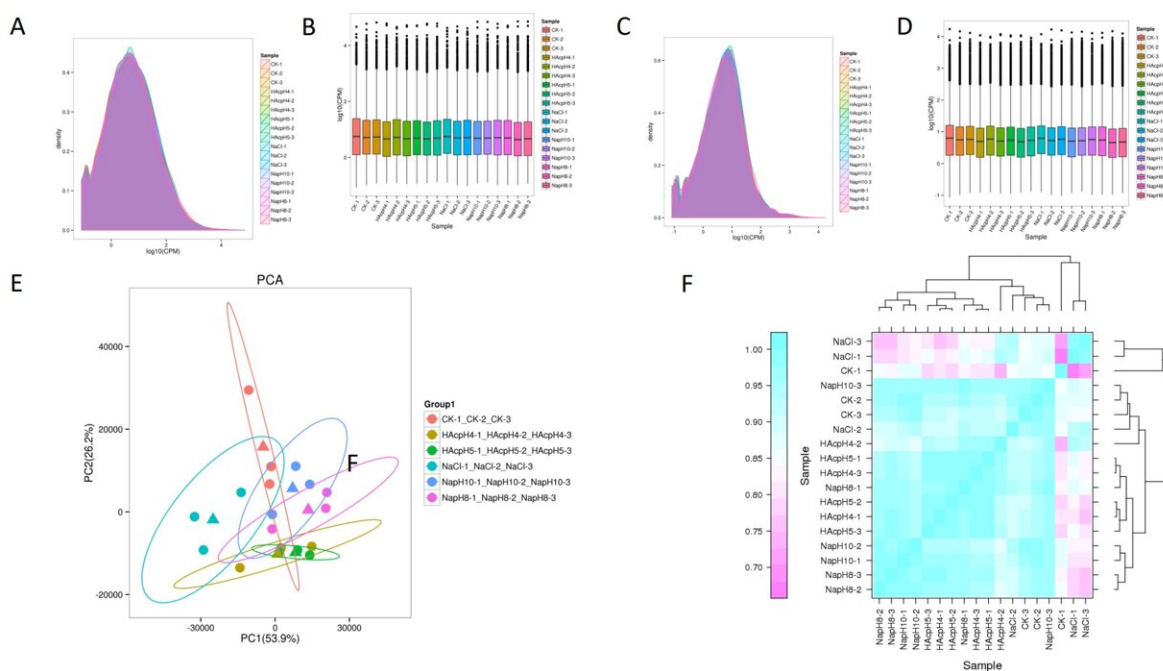


Scientists reveal regulation mechanism of soybean cyst nematode responses to chemical signals

June 8 2023, by Li Yuan



Distribution of gene expression (A-B) and transcript (C-D) expression of each sample and correlation among all 18 samples (E, F). A, C: Comparison map of the CPM density distribution of gene (A) and transcript (C) expression. B, D: CPM boxplot for gene (B) and transcript (D) expression. E, principal component analysis (PCA) of 18 samples. F, Heatmap of expression correlation between every two samples. Credit: *Journal of Agricultural and Food Chemistry* (2023). DOI: 10.1021/acs.jafc.3c00908

Soybean cyst nematode (SCN, *Heterodera glycines* Ichinohe), is a devastating pathogen in soybean. The infective juveniles of nematodes can use phytochemical signals (semiochemicals) released into the rhizosphere as important cues for host seeking, host locating and penetrating.

Disrupting host-seeking signals to prevent nematode infection is a promising approach to control nematodes in the soil. The attraction and repellence of nematodes to chemical signals are closely tied to their chemosensory system.

Based on full-length transcriptome sequencing, a research team led by Prof. Wang Congli from the Northeast Institute of Geography and Agroecology of the Chinese Academy of Sciences has chosen soybean cyst nematodes as a model system to investigate plant-parasitic nematode behavior and gene expression changes in response to acidic and basic pH and salt signals.

This study was published in the *Journal of Agricultural & Food Chemistry*.

Transcriptome sequencing indicated that 3,972 novel genes and 29,529 novel transcripts were identified. Sequence structural variation during or post transcription may be associated with the nematode's behavioral response.

The [functional analysis](#) of 1,817/4,962 differentially expressed genes (DEGs) showed that [signal transduction pathways](#), including transmembrane receptors, ion channels and Ca_2^+ transporters, were activated, but pathways involved in nematode development (e.g., ribosome) and [energy production](#) (e.g., oxidative phosphorylation) were inhibited.

The activated transmembrane G-protein coupled receptors included chemoreceptor Srsx, Wnt receptor MOM-5 (frizzled 1/7), dopamine receptor F59.D12.1, neuropeptide receptor 18, M3 acetylcholine receptor, and hormone thyrotropin receptor.

Additionally, [nicotinic acetylcholine receptor](#), γ -aminobutyric acid receptor subunit beta, and guanylate cyclase receptor 18 could regulate ion channels, while ion transporters plasma membrane Ca_2^+ ATPase, ion channel voltage-gated calcium channel and transient receptor potential channel TRP-1 (TRPC4) were also activated.

The receptor activation and inhibition in growth and development indicated that nematodes sustained energy balance by regulating [metabolic pathway](#) in favorable conditions, which also explained why [soybean cyst nematode](#) disease is severe in acidic, basic or high salt soil.

A regulatory model responding to pH and salt ion stimulation was established by the combination of DEGs and protein-protein interaction analysis. The findings from the model suggest that these identified receptors and [ion channels](#) might be potential targets for nematicides to control plant parasitic nematodes or drug discovery to control human or animal parasitic nematodes.

More information: Ye Jiang et al, Full-Length Transcriptome Analysis of Soybean Cyst Nematode (*Heterodera glycines*) Reveals an Association of Behaviors in Response to Attractive pH and Salt Solutions with Activation of Transmembrane Receptors, Ion Channels, and Ca_2^+ Transporters, *Journal of Agricultural and Food Chemistry* (2023). [DOI: 10.1021/acs.jafc.3c00908](https://doi.org/10.1021/acs.jafc.3c00908)

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