

Differential Metabolomic Response of Tomato Hybrids to Insect Herbivory



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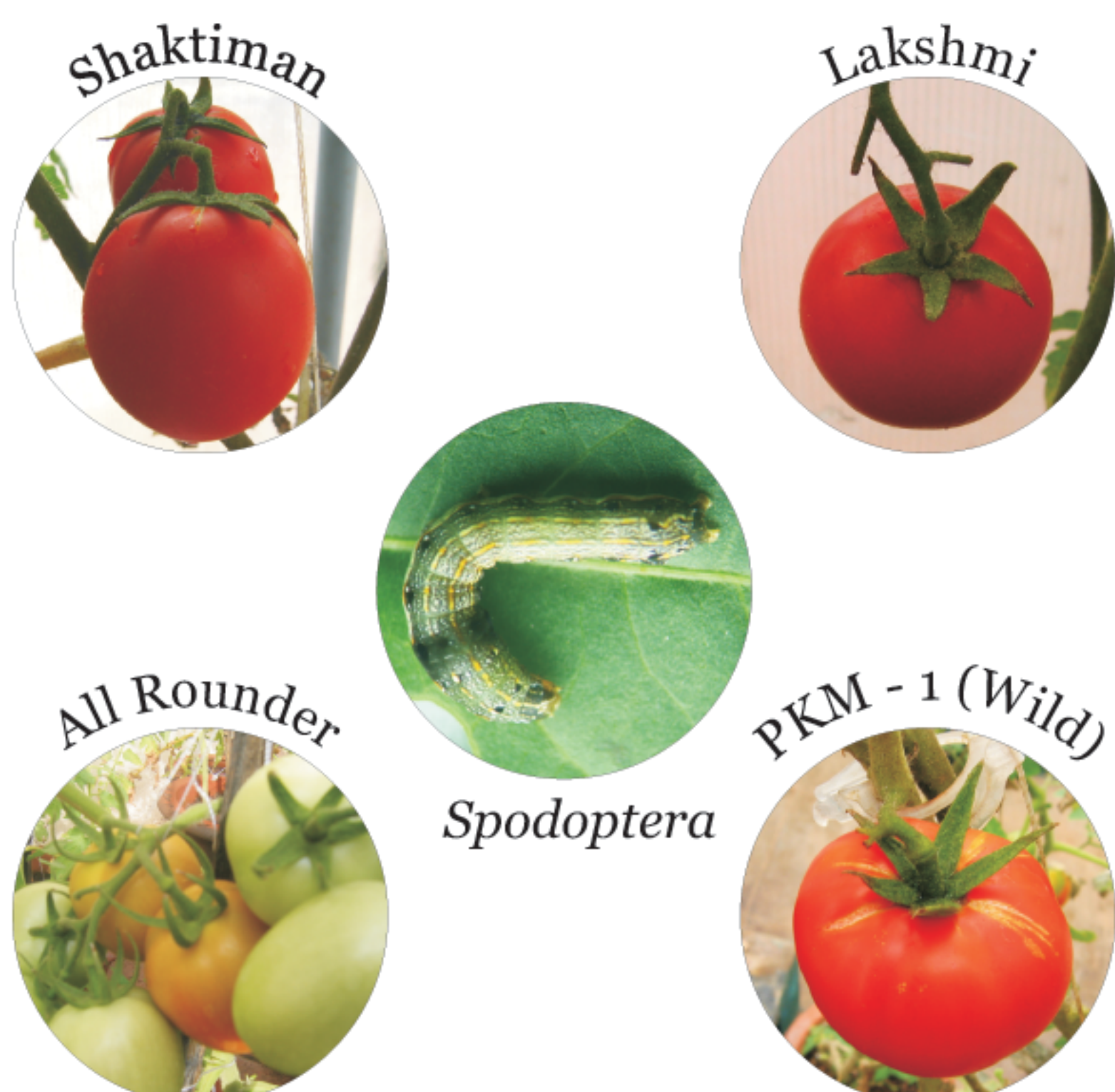
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Why this study?

- ★ Generating chemical profiles and metabolomic base for use in developing novel plant defense strategies based on plant-insect “cross-talk”.
- ★ To decode the “cross talk” inside and outside the plant at the level of transcripts, metabolites, and signals to the external environments.
- ★ To understand and depict a composite picture in “in-planta’ and “ex-plants” communications and their effect.



Works

- ★ Analysis of Herbivore Induced Plant Volatiles (HIPVs) in tomato (Lycopersicon esculentum) cultivars
- ★ Spatial and temporal survey of HIPVs
- ★ Chemical profiling using GC-MS headspace analyzer
- ★ Transcript- analysis of interactions and responses
- ★ Target plant: Tomato cultivars PKM-1, All Rounder, Lakshmi and Shaktiman
- ★ Target Insect: Spodoptera litura Fab.

Results

Quantum of volatiles emitted by tomato cultivars

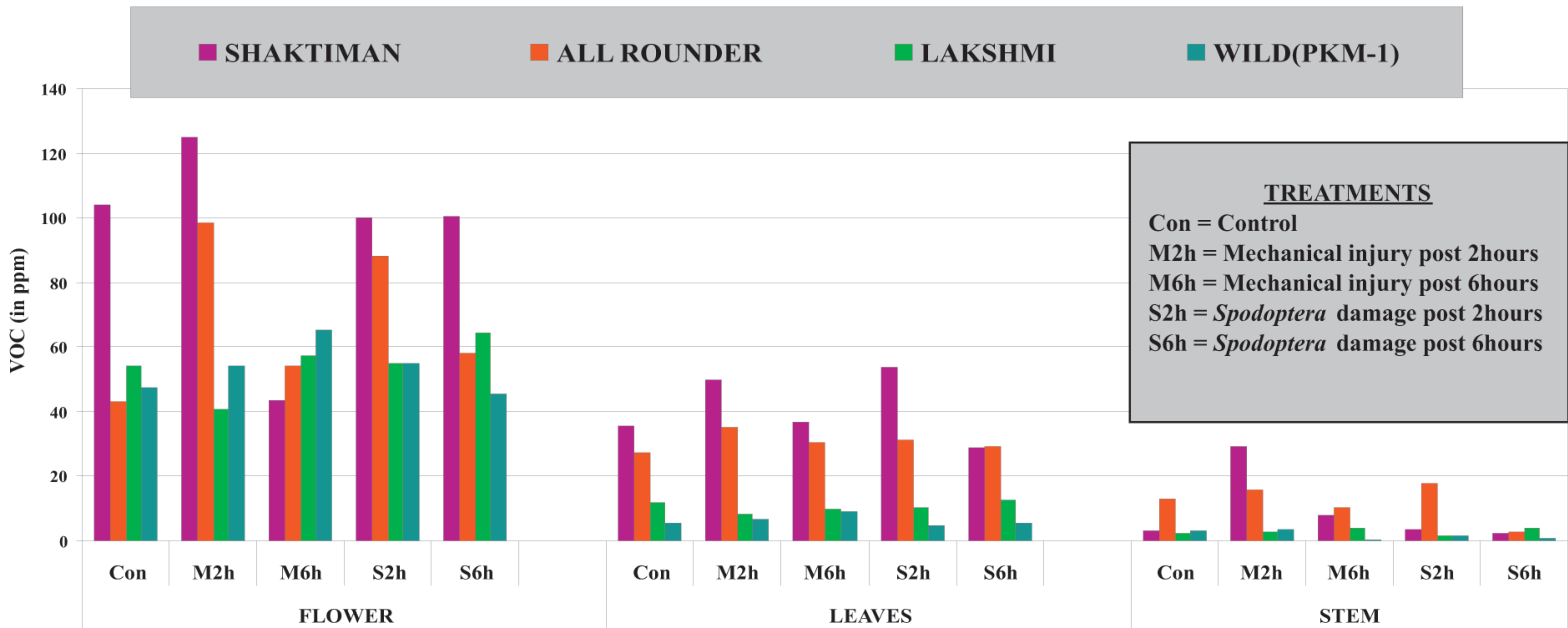


Fig 1. Total volatile organic compounds (VOCs) emitted by different plant parts on exposure to mechanical and insect damage

- ★ Flowers and leaves exhibit a significantly higher metabolic response to induction
- ★ A distinct quantitative and response to mechanical and insect damage
- ★ Mechanical injury in flowers with more cues to beneficial insect species

VOC Profiles as Metabolic Signatures

- ★ Characteristic pattern in reproductive and vegetative organs
- ★ Heightened response observed in agronomically superior cultivar

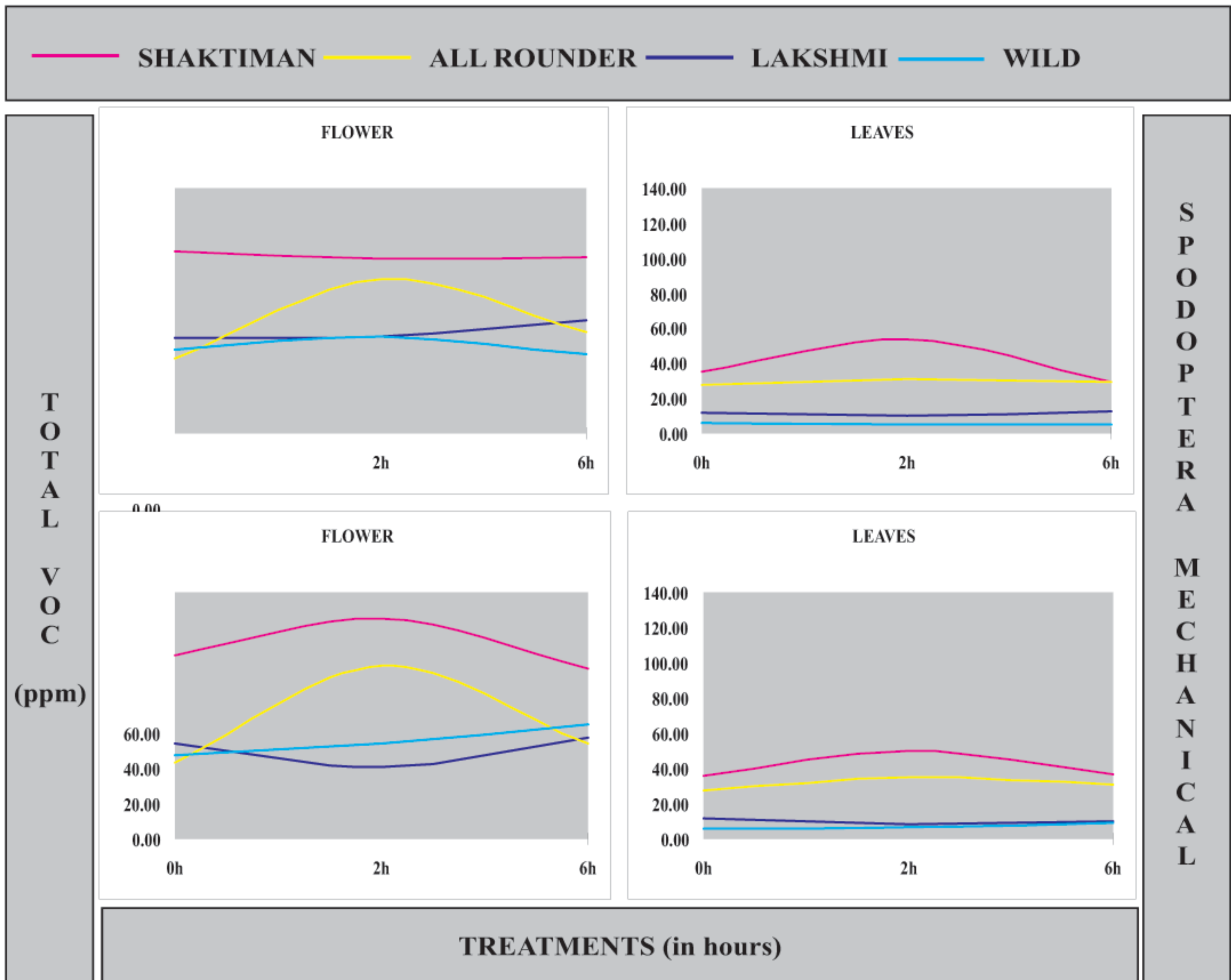


Fig 2. VOC profiles in Flower and Leaves of Four Tomato Cultivars

Day and Night Dilemma

- ★ Distinct volatile emission pattern during day and night
- ★ Diurnal Spodoptera induction shows - Phenylethanal(1), Phenethanol(2), 2-Propenoic acid-2-methyl oxiranylmethylester(3)
- ★ Two hour post herbivory with maximal metabolite response in tomato plants

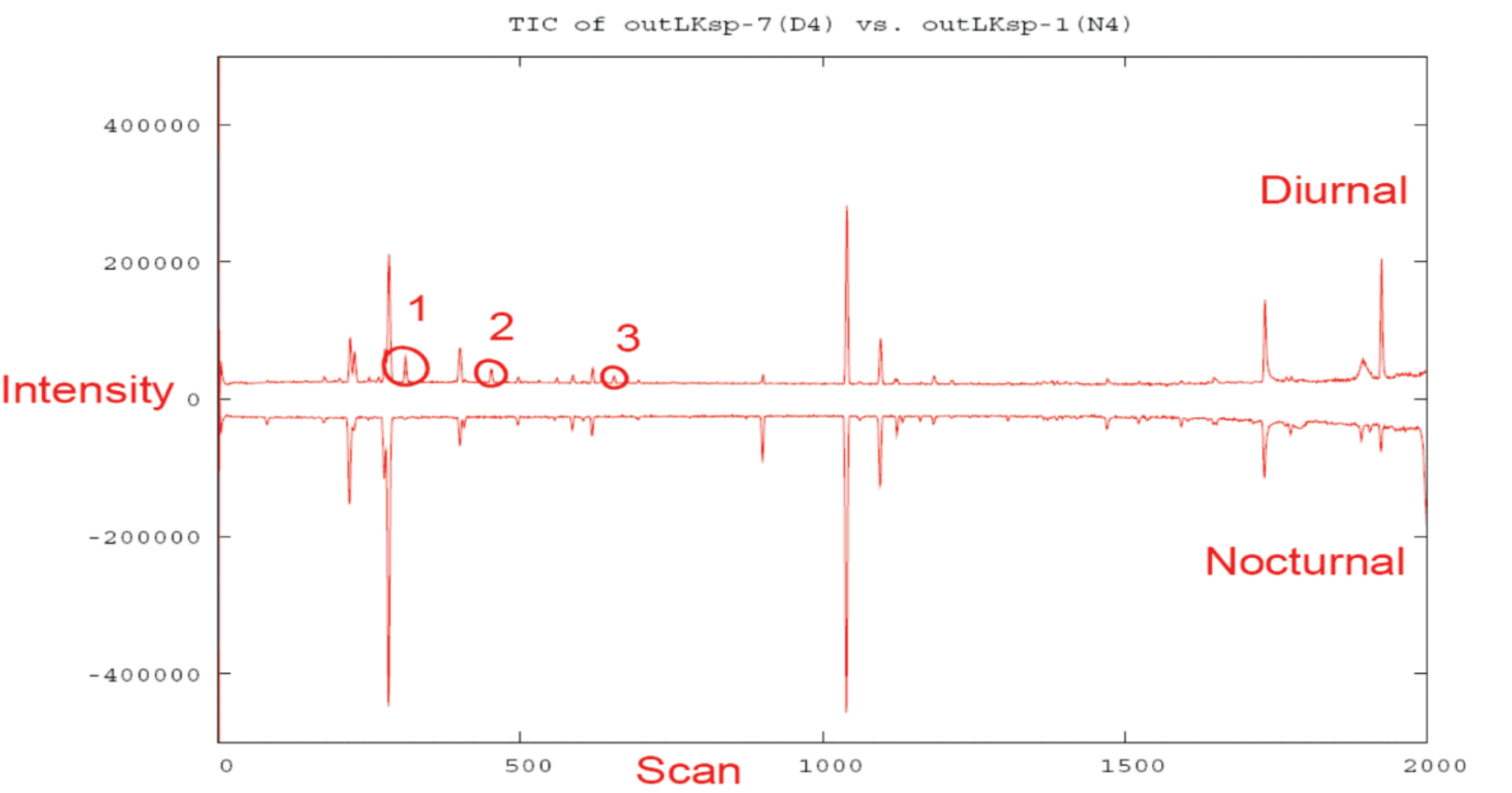


Fig 3. Head to tail Comparison of Diurnal-Nocturnal Spectrum of Jonathan et al., (2004) Post 4hours Spodoptera damage in Lakshmi Cultivar

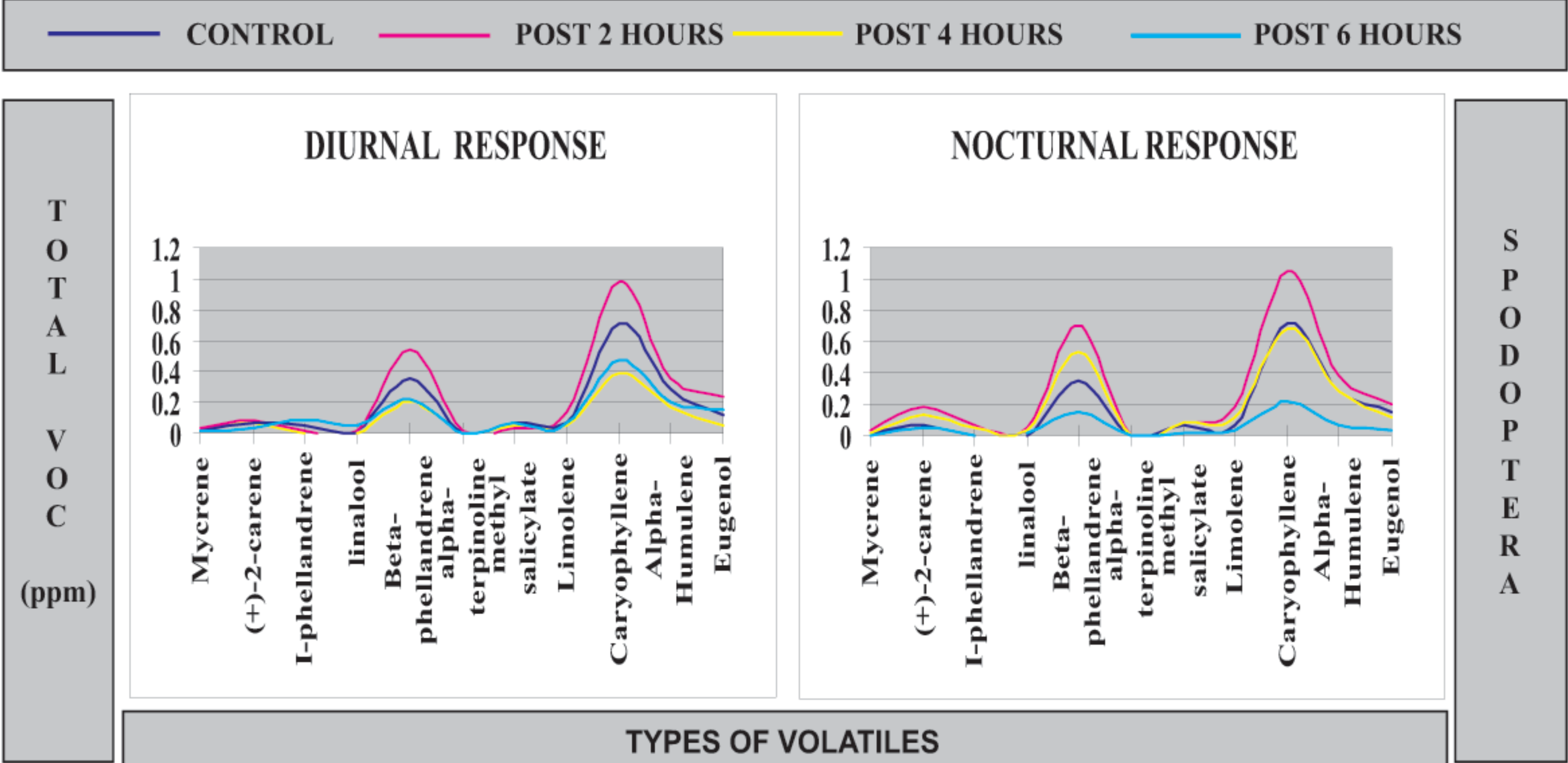


Fig 4.Diurnal -Nocturnal responses of different VOCs in Lakshmi Cultivar

Studying the transcripts

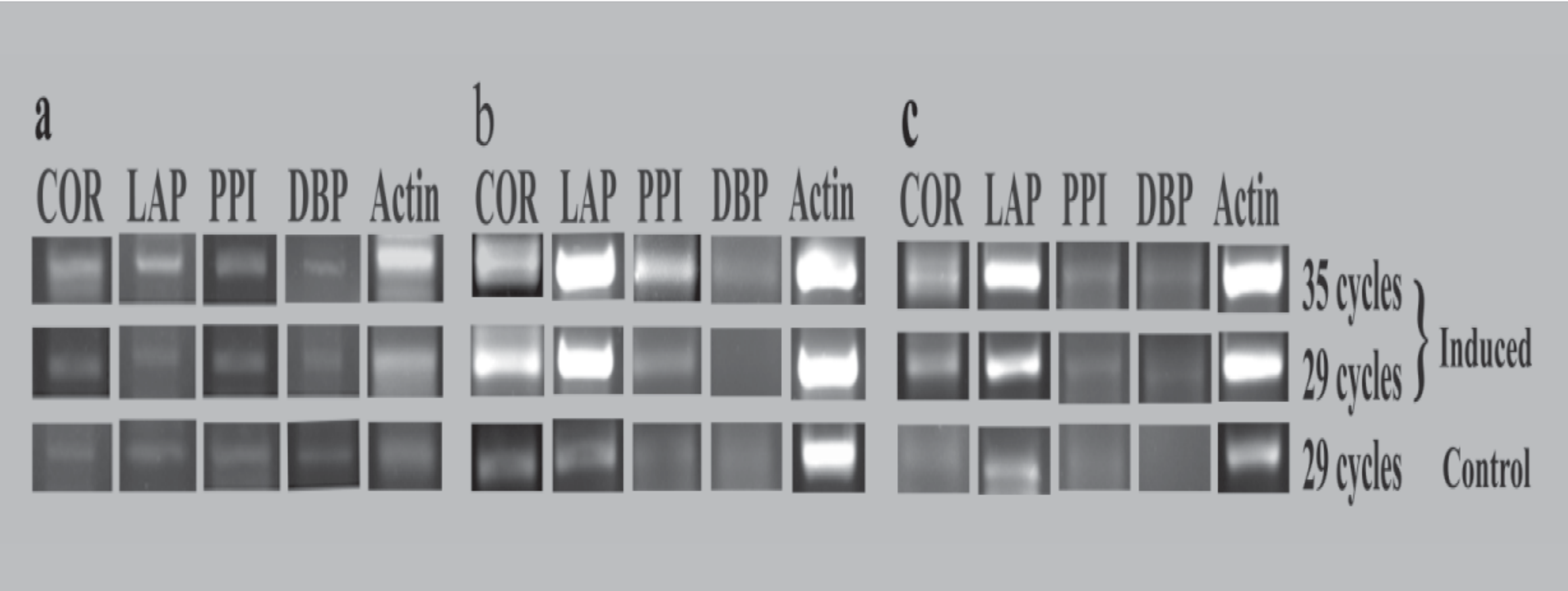


Fig 5: Transcripts of the four genes up regulated in the event of attack by Spodoptera litura in All Rounder (a), Lakshmi (b) and Shaktiman (c).



Downstream targets of JA pathway up regulated

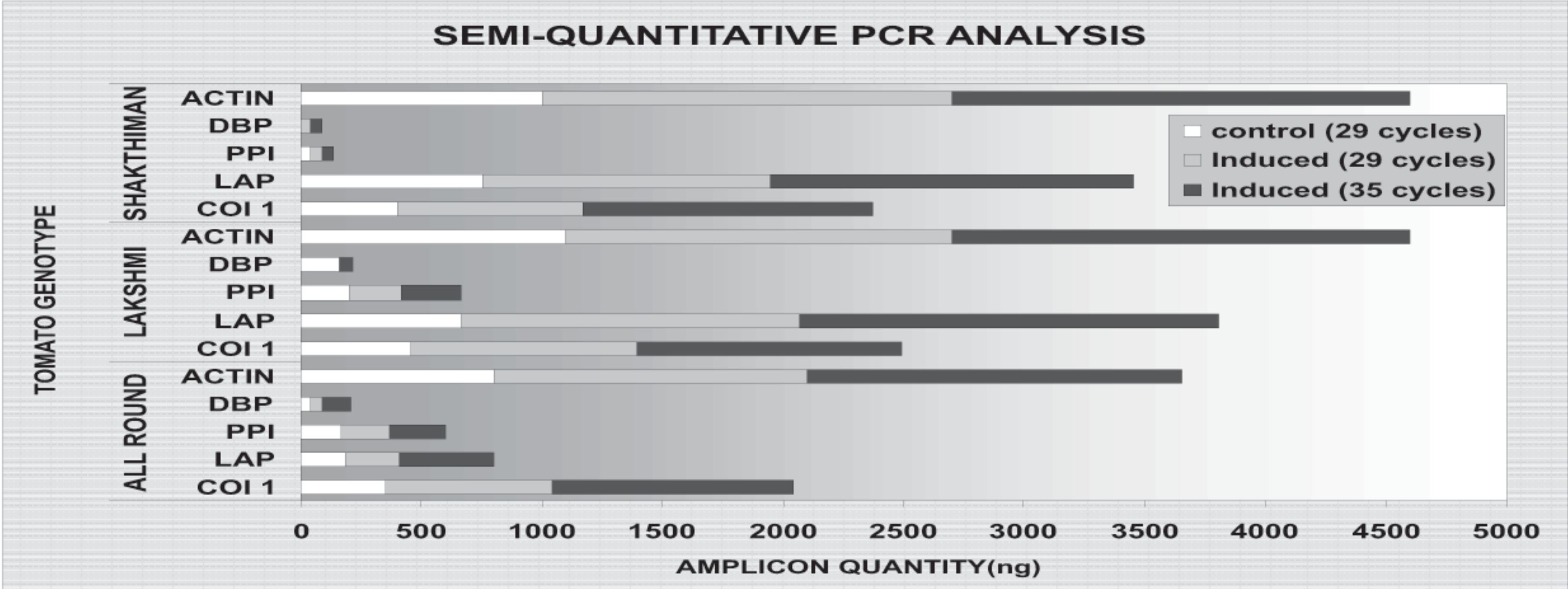


Fig 6 : Transcripts of the four genes up regulated in the event of attack by Spodoptera litura.

Summary

- ★ Distinct HIPV profiles of the tomato cultivars
- ★ Induced VOC profiles can be corroborated to the insect pest incidence
- ★ Nocturnal insects like Spodoptera induce a characteristic diurnal HIPV response
- ★ Transcripts of important downstream targets of JA signaling pathway elevated after 2 hours of Insect attack.
- ★ The interactions between the plant, insect and environment presents a complex but a tangible way forward to seed novel approaches of plant defense