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On the Cover: In each plant lineage, some pathways have evolved that diverge from primary metabolism and lead to the synthesis of specialized compounds (secondary metabolites) with diverse ecological roles, many of them involving defense. Some of these compounds can be toxic to a predatory organism through external or internal contact and are occasionally synthesized in dedicated cells such as glandular trichomes, perhaps because they divert primary metabolic pathways and also because they might be toxic to the plant itself. The background image shows the surface of a leaf of a wild tomato (*Solanum habrochaites* f. sp. *glabratum*) with its dense distribution of glandular trichomes and (out of focus) long, non-glandular trichomes. Superimposed is a scanning electron micrograph image of a single glandular trichome, which serves as the site of synthesis and accumulation of methylketones (mostly 2-tridecanone and 2-undecanone), compounds that are toxic to many insects. In this issue, Ben-Israel et al. (pp. 1952–1964) investigated the polygenic basis for the monophyletic divergence of this metabolic pathway (found in only in one wild species of tomato) from fatty acid biosynthesis. Comprehensive analysis of progeny derived from an interspecific cross between the cultivated and wild species revealed tight correlation between the shape of the glandular trichomes and their methylketone content. In addition, the presence of a wild species-specific transcript for a novel thioesterase, named *Methylketone Synthase2* (*MKS2*), showed significant correlation with methylketone accumulation as well as epistatic interactions with the previously identified gene *MKS1* in this pathway. Cover design and leaf picture made by Eran Pichersky and Eyal Fridman. Photograph of the scanning electron micrograph taken by Jihong Wang.

ON THE INSIDE

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HIGH IMPACT

MoTo DB: A Metabolic Database for Tomato. *Aleel K. Grennan* 1701

GENOME ANALYSIS

^{[C][W][OA]}Genetic Resources for Maize Cell Wall Biology. *Bryan W. Penning, Charles T. Hunter III, Reuben Tayengwa, Andrea L. Eveland, Christopher K. Dugard, Anna T. Olek, Wilfred Vermerris, Karen E. Koch, Donald R. McCarty, Mark F. Davis, Steven R. Thomas, Maureen C. McCann, and Nicholas C. Carpita* 1703

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^[OA]In Situ Mapping of Nutrient Uptake in the Rhizosphere Using Nanoscale Secondary Ion Mass Spectrometry. *Peta L. Clode, Matt R. Kilburn, David L. Jones, Elizabeth A. Stockdale, John B. Cliff III, Anke M. Herrmann, and Daniel V. Murphy* 1751

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- [C][W][O]A]Deciphering Transcriptional and Metabolic Networks Associated with Lysine Metabolism during Arabidopsis Seed Development. *Ruthie Angelovici, Aaron Fait, Xiaohong Zhu, Jędrzej Szymanski, Ester Feldmesser, Alisdair R. Fernie, and Gad Galili* 2058

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- [W][O]A]The Variegated Mutants Lacking Chloroplastic FtsHs Are Defective in D1 Degradation and Accumulate Reactive Oxygen Species. *Yusuke Kato, Eiko Miura, Kunio Ido, Kentaro Ifuku, and Wataru Sakamoto* 1790
- [W]A Cytoplasmically Inherited Barley Mutant Is Defective in Photosystem I Assembly Due to a Temperature-Sensitive Defect in *ycf3* Splicing. *Alejandra Mabel Landau, Heiko Lokstein, Henrik Vibe Scheller, Verónica Lainez, Sara Maldonado, and Alberto Raúl Prina* 1802
- [W][O]A]Effect of Rubisco Activase Deficiency on the Temperature Response of CO₂ Assimilation Rate and Rubisco Activation State: Insights from Transgenic Tobacco with Reduced Amounts of Rubisco Activase. *Wataru Yamori and Susanne von Caemmerer* 2073

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- [W]Arabidopsis FAB1/PIKfyve Proteins Are Essential for Development of Viable Pollen. *Paul Whitley, Steven Hinz, and James Doughty* 1812
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- [C][W][O]A]Peroxisomes Are Required for in Vivo Nitric Oxide Accumulation in the Cytosol following Salinity Stress of Arabidopsis Plants. *Francisco J. Corpas, Makoto Hayashi, Shoji Mano, Mikio Nishimura, and Juan B. Barroso* 2083
- [W][O]A]The Association of the Arabidopsis Actin-Related Protein2/3 Complex with Cell Membranes Is Linked to Its Assembly Status But Not Its Activation. *Simeon O. Kotchoni, Taya Zakharova, Eileen L. Mallery, Jie Le, Salah El-Din El-Assal, and Daniel B. Szymanski* 2095

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- [W][O]A]Mechanical Stimuli Modulate Lateral Root Organogenesis. *Gregory L. Richter, Gabriele B. Monshausen, Alexandra Krol, and Simon Gilroy* 1855
- [W][O]A]*Petunia hybrida* CAROTENOID CLEAVAGE DIOXYGENASE7 Is Involved in the Production of Negative and Positive Branching Signals in *Petunia*. *Revel S.M. Drummond, N. Marcela Martínez-Sánchez, Bart J. Janssen, Kerry R. Templeton, Joanne L. Simons, Brian D. Quinn, Sakuntala Karunairetnam, and Kimberley C. Snowden* 1867
- [W][O]A]Distal Expression of *knotted1* in Maize Leaves Leads to Reestablishment of Proximal/Distal Patterning and Leaf Dissection. *Julio Ramirez, Nathalie Bolduc, Damon Lisch, and Sarah Hake* 1878

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- [C]Expression of the Arabidopsis Mutant *abi1* Gene Alters Abscisic Acid Sensitivity, Stomatal Development, and Growth Morphology in Gray Poplars. Matthias Arend, Jörg-Peter Schnitzler, Barbara Ehltling, Robert Hänsch, Theo Lange, Heinz Rennenberg, Axel Himmelbach, Erwin Grill, and Jörg Fromm 2110

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- [C][W]Altered Architecture and Enhanced Drought Tolerance in Rice via the Down-Regulation of Indole-3-Acetic Acid by *TLD1/OsGH3.13* Activation. Sheng-Wei Zhang, Chen-Hui Li, Jia Cao, Yong-Cun Zhang, Su-Qiao Zhang, Yu-Feng Xia, Da-Ye Sun, and Ying Sun 1889
- [C][W][OA]Upgrading Root Physiology for Stress Tolerance by Ectomycorrhizas: Insights from Metabolite and Transcriptional Profiling into Reprogramming for Stress Anticipation. Zhi-Bin Luo, Dennis Janz, Xiangning Jiang, Cornelia Göbel, Henning Wildhagen, Yupeng Tan, Heinz Rennenberg, Ivo Feussner, and Andrea Polle 1902
- [W][OA]The Impact of Water Deficiency on Leaf Cuticle Lipids of Arabidopsis. Dylan K. Kosma, Brice Bourdenx, Amélie Bernard, Eugene P. Parsons, Shiyu Lü, Jérôme Joubès, and Matthew A. Jenks 1918
- [W]Specific Domain Structures Control Abscisic Acid-, Salicylic Acid-, and Stress-Mediated *SIZ1* Phenotypes. Mi Sun Cheong, Hyeong Cheol Park, Mi Ju Hong, Jiyoung Lee, Wonkyun Choi, Jing Bo Jin, Hans J. Bohmert, Sang Yeol Lee, Ray A. Bressan, and Dae-Jin Yun 1930
- [W][OA]Uncovering Small RNA-Mediated Responses to Phosphate Deficiency in Arabidopsis by Deep Sequencing. Li-Ching Hsieh, Shu-I. Lin, Arthur Chun-Chieh Shih, June-Wei Chen, Wei-Yi Lin, Ching-Ying Tseng, Wen-Hsiung Li, and Tzyy-Jen Chiou 2120

GENETICS, GENOMICS, AND MOLECULAR EVOLUTION

- [W][OA]Extensive Structural Renovation of Retrogenes in the Evolution of the *Populus* Genome. Zhenglin Zhu, Yong Zhang, and Manyuan Long 1943
- [W][OA]Multiple Biochemical and Morphological Factors Underlie the Production of Methylketones in Tomato Trichomes. Imri Ben-Israel, Geng Yu, Michael B. Austin, Nazmul Bhuiyan, Michele Auldridge, Thuong Nguyen, Ines Schauvinhold, Joseph P. Noel, Eran Pichersky, and Eyal Fridman 1952
- [W][OA]Nucleotide Polymorphism in the Wheat Transcriptional Activator *Spa* Influences Its Pattern of Expression and Has Pleiotropic Effects on Grain Protein Composition, Dough Viscoelasticity, and Grain Hardness. Catherine Ravel, Pierre Martre, Isabelle Romeuf, Mireille Dardevet, Redouane El-Malki, Jacques Bordes, Nathalie Duchateau, Dominique Brunel, François Balfourier, and Gilles Charmet 2133

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- [W]Identification of Defense Compounds in *Barbarea vulgaris* against the Herbivore *Phyllotreta nemorum* by an Ecometabolomic Approach. Vera Kuzina, Claus Thorn Ekstrøm, Sven Bode Andersen, Jens Kvist Nielsen, Carl Erik Olsen, and Søren Bak 1977
- [W]The Ectomycorrhizal Fungus *Laccaria bicolor* Stimulates Lateral Root Formation in Poplar and Arabidopsis through Auxin Transport and Signaling. Judith Felten, Annegret Kohler, Emmanuelle Morin, Rishikesh P. Bhalerao, Klaus Palme, Francis Martin, Franck A. Ditengou, and Valérie Legué 1991
- [C][W][OA]An ABC Transporter Mutation Alters Root Exudation of Phytochemicals That Provoke an Overhaul of Natural Soil Microbiota. Dayakar V. Badri, Naira Quintana, Elie G. El Kassis, Hye Kyong Kim, Young Hae Choi, Akifumi Sugiyama, Robert Verpoorte, Enrico Martinoia, Daniel K. Manter, and Jorge M. Vivanco 2006
- [OA]Native Plant and Microbial Contributions to a Negative Plant-Plant Interaction. Gurdeep Bains, Amutha Sampath Kumar, Thimmaraju Rudrappa, Emily Alff, Thomas E. Hanson, and Harsh P. Bais 2145
- [C][OA]Airborne Induction and Priming of Plant Defenses against a Bacterial Pathogen. Hwe-Su Yi, Martin Heil, Rosa M. Adame-Álvarez, Daniel J. Ballhorn, and Choong-Min Ryu 2152

WHOLE PLANT AND ECOPHYSIOLOGY

- Stomatal Crypts Have Small Effects on Transpiration: A Numerical Model Analysis. *Anita Roth-Nebelsick, Foteini Hassiotou, and Erik J. Veneklaas* 2018

SYSTEMS BIOLOGY, MOLECULAR BIOLOGY, AND GENE REGULATION

- ^[C]^[W]^[OA]DkMyb4 Is a Myb Transcription Factor Involved in Proanthocyanidin Biosynthesis in Persimmon Fruit. *Takashi Akagi, Ayako Ikegami, Tomoyuki Tsujimoto, Shozo Kobayashi, Akihiko Sato, Atsushi Kono, and Keizo Yonemori* 2028
- ^[W]^[OA]The Phytochrome-Interacting Factor PIF7 Negatively Regulates *DREB1* Expression under Circadian Control in Arabidopsis. *Satoshi Kidokoro, Kyonoshin Maruyama, Kazuo Nakashima, Yoshiyuki Imura, Yoshihiro Narusaka, Zabta K. Shinwari, Yuriko Osakabe, Yasunari Fujita, Junya Mizoi, Kazuo Shinozaki, and Kazuko Yamaguchi-Shinozaki* 2046
- ^[C]^[W]Replication Protein A (RPA1a) Is Required for Meiotic and Somatic DNA Repair But Is Dispensable for DNA Replication and Homologous Recombination in Rice. *Yuxiao Chang, Liang Gong, Wenya Yuan, Xingwang Li, Guoxing Chen, Xianghua Li, Qifa Zhang, and Changyin Wu* 2162
- ^[W]A T9G Mutation in the Prototype TATA-Box TCACTATATATAG Determines Nucleosome Formation and Synergy with Upstream Activator Sequences in Plant Promoters. *Amol Ranjan, Suraiya A. Ansari, Rakesh Srivastava, Shrikant Mantri, Mehar H. Asif, Samir V. Sawant, and Rakesh Tuli* 2174

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^[W] Indicates Web-only data.

^[OA] Open Access articles can be viewed online without a subscription.