

Functional Plant Biology

Contents

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Review: Interactions of endoparasitic and ectoparasitic nematodes within the plant root system

Francine Perrine-Walker 295–303

Plant parasitic nematodes cause major crop losses worldwide. Some of these nematodes have sophisticated mechanisms to invade the roots of important agricultural crops such as wheat, sugarcane and soybean. This review provides a summary of how root-knot, cyst and root-lesion nematodes infect the plant roots, as well as the different approaches used to control and manage these nematodes in Australian agricultural soils.

Overexpression of a soybean 4-coumaric acid: coenzyme A ligase (*GmPI4L*) enhances resistance to *Phytophthora sojae* in soybean

Xi Chen, Xin Fang, Youyi Zhang, Xin Wang, Chuanzhong Zhang, Xiaofei Yan, Yuanling Zhao, Junjiang Wu, Pengfei Xu and Shuzhen Zhang 304–313

Glyceollins and isoflavones are soybean-derived phytoalexins in response to *Phytophthora sojae* that causes stem and root rot on soybeans worldwide. To understand the function of *Gm4CL*, we analysed and found that *GmPI4L* improves defence against *P. sojae* by enhancing glyceollins and isoflavones content. This study provides the theoretical foundation for clarifying the mechanism of the phenylpropanoid pathway in disease resistance in soybean.

Expression of sugarcane genes associated with perception of photoperiod and floral induction reveals cycling over a 24-hour period

Donna Glassop and Anne L. Rae 314–327

This is the first study to propose the gene pathway for floral induction in sugarcane. The expression pattern of 21 genes was examined over 24 h to identify cyclic patterns of expression. These profiles are important to determine when floral inductive conditions are perceived by sugarcane and why some varieties may not flower.

The electrical signal-induced systemic photosynthetic response is accompanied by changes in the photochemical reflectance index in pea

Vladimir Sukhov, Ekaterina Sukhova, Ekaterina Gromova, Lyubov Surova, Vladimir Nerush and Vladimir Vodenev 328–338

Wounding-induced electrical signals cause a systemic photosynthetic response in plants. We investigated the influence of electrical signals on photosynthesis and a photochemical reflectance index, which is widely used in remote sensing of plants. Changes in photosynthesis and the index were strongly connected. Thus the photochemical reflectance index can be used in remote sensing of the systemic photosynthetic response in higher plants.

Physiology and metabolism of grafted bell pepper in response to low root-zone temperature

Moses Kwame Aidoo, Tal Sherman, Naftali Lazarovitch, Aaron Fait and Shimon Rachmilevitch 339–349

Low temperature is a prominent limiting factor for tropical originated crop production in temperate regions, particularly during cool-season production. The diverse response of rootstocks physiology and metabolism were studied when exposed to aeroponically different temperature regimes at the root zone. The tolerance of grafted bell pepper demonstrated high sink potential contributing to milder reduction of photosynthesis and transpiration during treatment. GC-MS metabolite profiling showed enhance metabolism in leaves, as well as in the roots.

Cover illustration: Root knot nematode *Meloidogyne* spp. on tomato root (see Perrine-Walker pp. 295–303). (Upper left) Large galls or “knots” (black arrows). (Lower left) Enlarged female nematode (n) with egg mass attached. (Upper right) Giant cells (GC) and the perturbed vascular system (white arrow). (Lower right) Juvenile J2/vermiform nematode within mature root knot. Image by Francine Perrine-Walker.

Nitrogen increases drought tolerance in maize seedlings
**Yushuang Song, Jinlu Li, Mingli Liu, Zhe Meng,
Kaichang Liu and Na Sui** 350–359

Drought and nitrogen availability are two important environmental factors that affect plant growth and global distribution of plants. We examined the effect of nitrogen on physiological characters of maize seedlings under drought stress and find that moderate nitrogen supply increases plant resistance to drought stress. These findings are important for guiding the agricultural use of nitrogen fertilisers.

Hydroponic grown tobacco plants respond to zinc oxide nanoparticles and bulk exposures by morphological, physiological and anatomical adjustments
**Maryam Mazaheri Tirani,
Maryam Madadkar Haghighi
and Ahmad Ismaili** 360–375

Hydroponic systems could be a reliable, versatile and sensitive method to investigate the plant responses to the nanoparticle exposure. As ZnO nanoparticles (NPs) and bulk forms possess unique physicochemical characteristics, they are globally used in different industries and may influence plant growth in the environment. As an extensive investigation of the effect of both ZnO NPs and bulk form ZnO on various morphological, physiological and anatomical features of tobacco plants, the present study pinpoints the responses compatible with ZnO-induced stress.

Promoter deletion analysis reveals root-specific expression of the alkenal reductase gene (*OsAER1*) in *Oryza sativa*
**Aniversari Apriana, Atmitri Sisharmini,
Hajrial Aswidinnoor, Kurniawan R. Trijtmiko
and Sudarsono Sudarsono** 376–391

Roots play an important role in dehydration and either soil-related nutrient deficiency or toxicity responses, which may be alleviated by transgenic plants. We evaluated *OsAER1* root-specific promoter in transgenic rice and identified *cis*-acting elements controlling the expression. *OsAER1* promoter may have implications in the development of transgenic crops requiring root-specific gene expression aimed at improving responses to dehydration, nutrient deficiency or toxicity stress.