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Polyclonal Antibodies for Detection of Witches' Broom Disease of Lime

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Dear Editor,

The witches' broom disease of lime trees is a destructing disease caused by the bacterium *Candidatus* Phytoplasma aurantofolia (1). The disease is prevalent in Oman, United Arab Emirates and Iran. To restrict the spread of the infected trees, detection of the causative bacterium is crucial. Besides PCR-based methods, antibodies can be applied for detection of pathogen-infected cells.

Recently Shahryari et al. demonstrated that polyclonal antibodies generated against a cell surface protein of the bacterium could be used for efficient detection of phytoplasma-infected plant cells (2). In their very conclusive publication the authors describe generation and binding of polyclonal antibodies against the immunodominant membrane protein (IMP) of *Candidatus* Phytoplasma aurantifolia. Immunization of rabbits with recombinant antigen resulted in polyclonal antibodies with very high titer, which enabled the development of a highly sensitive, but simple ELISA assay for phytoplasma detection in infected plants. For studying plant cell-phytoplasma interaction, specific antibodies against cell surface proteins of *Candidatus* Phytoplasma aurantifolia and the host cell would be useful. However monoclonal or recombinant antibodies instead of polyclonal antibodies have to be developed for more detailed analysis of a protein function. Recombinant antibodies can be selected from universal naive or synthetic antibody display libraries (3), especially phage display libraries (4). Antibody display on the surface of two types of bacteriophage, fd and M13, is currently the most widespread method for the display. Selection of recombinant antibodies is coupled with selection of the corresponding antibody genes. The antibody genes can further be modified (for example fusion of Fc domains, enzymes, biotin, fluorescence molecules, cytokines or toxins). Recently Shahriyari et al., isolated scFv fragments against the immunodominant membrane protein (IMP) of *Candidatus* Phytoplasma aurantifolia by phage display (5). These scFv fragments could be applied as intracellular antibodies in plants (plantibodies, (6)). Plantibodies are able to interfere with the multiplication of pathogens by inhibiting the function of viral or bacterial proteins. Recently this was demonstrated with a scFv fragment recognizing the major membrane protein of the stolbur phytoplasma (7).

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The author has conducted the whole manuscript.

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