Three-decade application and innovation of electrical penetration graph (EPG) technique in China

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Since 1990's, electrical penetration graph (EPG) has been applied in China in biological and agricultural fields, including plant-insect interactions, plant resistance mechanisms, virus transmission, safety assessment of transgenic crops, global climatic change, with agricultural and forestry piercing-sucking insects (Hemiptera) including aphids, whiteflies, leafhoppers, planthoppers, scale insects, psyllids as well as thrips (Thysanoptera). Five training courses and symposia on EPG technique have been held in China since 2007. EPG instrument have been innovated and manufactured in China, and most consumable materials (such as gold wires and silver glue) have been available domestically. EPG-related application techniques or methods, for example, EPG recording on artificial diet (membrane-feeding) and honeydew clock, have been optimized. EPG use in fields on insect pests of medical or veterinary significance will become a new trend in future years. In addition, we need to put more effects on the following work: automatization and visualization of EPG instrument, AI-based automatic recognition of waveforms, optimization of variable/parameter system. In our laboratory, we applied DC-EPG to record virus/symbiont-altered feeding behaviors of *Bemisia tabaci*. *Cucurbit chlorotic yellows virus* (CCYV), transmitted semi-persistently by *B. tabaci*, is a newly emerging virus causing serious losses to cucurbit plants worldwide. EPG results showed that CCYV could manipulate, either directly or indirectly, the feeding behaviors of its vectors to various degrees, depending on different biotypes and sexes. The results indicated that CCYV manipulates the feeding behavior of whiteflies, which may lead to more possibilities for CCYV transmission. We also used EPG system to monitor the feeding behaviors of *B. tabaci* with (R+) or without (R-) an important secondary symbiont, Rickettsia on CCYV-infected and healthy cucumber plants. It was found that the total duration of np and the total number of pd were significantly different between *B. tabaci* with/out Rickettsia (R+) and (R-) and on CCYV-infected and healthy cucumber plants. From these results we could conclude that symbiont Rickettsia, alone or with CCYV, could affect host selection preference and feeding behaviors of *B. tabaci*.