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The Tunisian citrus certification program for sanitary improvement and production of healthy plants free from virus and virus like diseases started in 1994 and has the following objectives: a) virus sanitation of the local varieties by shoot-tip grafting *in vitro* (STG); b) introduction of foreign varieties from the San Giuliano Agricultural Research Station (INRA- IRFA, Corsica); c) introduction of new rootstocks tolerant to Tristeza such as *Citrus volkameriana*, *Citrumelo swingle* and *Citrango carrizo*. The organization and the steps of this program were established according to the Tunisian law of plant certification. This law has put the rules of sanitation controls that guarantee production of virus free certified plants mainly from *Citrus tristeza virus*, *Citrus psorosis virus*, virus like diseases (Impetratura, concave gum, blind pocket), *Citrus stubborn disease* caused by *spiroplasma citri* and viroids (mainly *Citrus exocortis viroid* and *Cahexia citrus viroid*). Healthy mother plants are conserved under screen-house and multiplied in order to obtain pre-basic and basic material that is delivered to nurseries. Since its establishment, this certification program allowed the sanitation of 18 local and 17 imported varieties. Nurseries are assisted and supplied with about 4000 basic plants grafted on tristeza tolerant rootstocks for the production of certified seedlings.

V17

THE SILENCING VECTOR BEAN POD MOTTLE VIRUS BREAKS RSV3-MEDIATED EXTREME RESISTANCE AGAINST SOYBEAN MOSAIC VIRUS. Mazen Alazem, Kristin Widyasari, John Bwalya and Kook-Hyung Kim, College of Agriculture and Life Sciences, Seoul National University, Seoul, Korea, Email: m.alazem@gmail.com

Studies on functional genomics necessitate the use of silencing vectors such as Bean pod mottle virus (BPMV) vector. Soybean cultivar L29, which carries the resistance gene *Rsv3*, exhibits extreme resistance (ER) against the G5H avirulent strain of Soybean mosaic virus (SMV), but not against the virulent G7H strain. This resistance is attributed to the induction of abscisic acid (ABA), the antiviral RNA silencing pathway, and callose deposition. In attempt to silence few genes important for ER in L29 plants, BPMV vector was employed. BPMV vector, however, highly induced the expression of many genes in the salicylic acid (SA) and the RNA silencing pathways in the control plants compared with the healthy untreated plants. *Rsv3* expression was reduced after BPMV infection, whereas genes involved in the ABA pathway remained unregulated in all soybean lines. Inductions of SA and RNA silencing genes were moderate in lines carrying *Rsv1* and *Rsv4* plants, and weak in *rsv*-null soybean plants. BPMV renders L29 plants more susceptible to G7H infection compared to untreated plants, but more interestingly, BPMV breaks the *Rsv3*-mediated ER of L29 against G5H allowing the latter to accumulate locally but not systemically. The coat protein large unit (CPL) of BPMV exhibited VSR activity in *Nicotiana* plants, and when CPL was expressed within the G5H genome, the latter accumulated locally but not systemically. Our findings suggest that the BPMV silencing vector breaks part of the

Rsv3-mediated ER against the SMV avirulent strain by impairing the antiviral RNA silencing pathway, and triggers SA-related defence in plants with antiviral *R*-genes. It can be also suggested that BPMV silencing vector might not be a useful tool to study plant-virus interactions, and that such observation might also occur for other similar viral vectors.

V18

VIRUSES CAUSING YELLOWING AND STUNTING SYMPTOMS IN CHICKPEA AND APPLYING INTEGRATED ECO-FRIENDLY APPROACHES FOR ITS EFFECTIVE CONTROL IN SYRIA. Nader Y. Asaad¹, Safaa G. Kumari², Amin A. Haj Kassem³, Abdul Rahman Moukahel² and Ertyad Y. Essa¹. (1) General Commission for Scientific Agricultural Research (GCSAR), Al-Ghab, Hama, Syria, Email: asaad_nader@yahoo.com; (2) International Center for Agricultural Research in the Dry Areas (ICARDA), Terbol Station, Beqa'a Valley, Zahle, Lebanon; (3) Department of Plant Protection, Faculty of Agriculture, Aleppo University, Aleppo, Syria

Chickpea (*Cicer arietinum* L.) ranks third among the pulse crops that attribute to global food security. Viruses that cause yellowing and stunting symptoms are considered a main threat to chickpea production worldwide. Currently, there is a great interest in applying eco-friendly smart technologies to achieve best control results. Results of serological [Tissue blot immunoassay (TBIA)] and molecular assays [Reverse transcription-polymerase chain reaction (RT-PCR)] used in field surveys carried out during four growing seasons (2006, 2007, 2017 and 2018) in chickpea fields, revealed that the polerovirus *Chickpea chlorotic stunt virus* (CpCSV) was dominant in all seasons. Thus, the objective of this study was to identify practices to reduce the effect of viruses causing yellowing and stunting of chickpea under Syrian ecology. This approach included screening 80 chickpea genotypes for virus resistance (obtained from ICARDA Gene Bank under open field conditions). To reduce virus incidence in the field several practices such as planting date, plant density, locations, cultivars (Ghab-3, Ghab-4, Ghab-5, promising variety FLIP95-65C and susceptible variety JG62), as well as intercropping between chickpea and other crops like flax (*Linum usitatissimum*), black cumin (*Nigella sativa*) and coriander (*Coriandrum sativum*) were evaluated. Results revealed that few chickpea genotypes (such as IG9000, IG69434, IG69656, IG69693, IG71832 and IG128651) were found resistant/tolerant for CpCSV and it could be used as a resistance source in chickpea breeding programs. Virus infection was decreased around 50-80% and crop yield was increased by 5-35% with high significant differences when chickpea was planted during the first half of December with plant density of 20-30 plants/m². In addition, yield was improved with low virus infection when chickpea was intercropped with flax in alternate lines or with coriander (1 line of coriander each 5-6 chickpea lines). Generally, the results confirmed the importance of the interaction between a number of practices which together formed an integrated system that influenced virus spread and can be considered a potential approach for sustainable virus diseases management.