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Guest Editor

Dr. Mejda Daami-Remadi

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Cover photos/figures: Top left and right: Microsclerotia and dark resting mycelia of *Verticillium tricorpus* on PDA; Dry rot developed on a potato tuber cv. 'Spunta' 30 days after its inoculation with *Verticillium tricorpus* (Jabnoun-Khiareddine *et al.*, pp 24-25). Center row: Plant growth of tomato plants (cv. 'Riogrande') in the different culture substrates, 60 days after inoculation with Forl (Hibar-Beji *et al.*, pp 20-23). Bottom: Competitive potential of *Trichoderma* spp. against *Verticillium* spp. observed after 6 days of dual culture on PDA at 20°C (Jabnoun-Khiareddine *et al.*, pp 26-36).

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The Guest Editor

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Foreword

Research activities undertaken at CRRHAB, especially the laboratory of Phytopathology, deals with soilborne fungi and fungus-like organisms responsible mainly of the vascular wilts of several vegetable crops (tomato, potato, melon, eggplant) caused by *Verticillium* spp. and *Fusarium oxysporum* (different *formae speciales* depending on host plants i.e. *lycopersici*, *radicis-lycopersici*, *tuberosi*, *melonis*) and post-harvest tuber diseases of potato such as Fusarium dry rot (different *Fusarium* species), Potato leak (*Pythium aphanidermatum* and *P. ultimum*), Pink rot (*Phytophthora erythroseptica*), Atypical soft rot (*Sclerotium rolfsii*), Black dot (*Colletotrichum coccodes*) and Rhizoctonia stem canker (*Rhizoctonia solani*).

Geographical distribution concerned especially the emergent pathogenic fungal species (*F. oxysporum* f. sp. *tuberosi* (FOT) and *S. rolfsii* (SR) on potato, and *V. albo-atrum* (VA) and *V. tricorpus* (VT) on tomato) and certain diseases of increasing incidence (*R. solani* (RS) and *C. coccodes* (CC) on potato and *V. dahliae* (VD) on tomato and melon). The geographical distribution of *V. dahliae* was performed at the physiological race level and it is ongoing for *F. oxysporum* f. sp. *melonis* (FOM) and *F. oxysporum* f. sp. *lycopersici* (FOL) races.

Biological characterization concerned the emergent pathogens and those detected for the first time on unusual hosts as is the case of VD on melon and artichoke. Morphological characterization was made especially for *Verticillium* spp. isolates. Molecular study of the genetic diversity of *F. oxysporum* f. sp. *radicis-lycopersici* (FORL) and some FOL Tunisian isolates by IGS-RFLP analysis concluded to an accidental introduction of pathogen.

Given the involvement of three components in disease triangle including the pathogen, the host-plant and the environmental conditions, the aggressiveness of pathogens was assessed depending on different biotic and abiotic factors. Comparative aggressiveness studies were conducted, under controlled and/or fields conditions, depending on causal agent (i.e. first disease component) species involved, isolates collected, physiological races recovered and inoculum dose (or seed tuber degree of infection for some skin blemishing potato diseases).

Pathogen aggressiveness was also estimated depending on plant material (i.e. second disease component) used i.e. cultivars, clones, crossbreeding lines, wild material, and local plant material. In fact, the plant × pathogen interactions performed for potato focused on the assessment of the behaviour of cultivars subscribed in list A belonging to the Tunisian varietal assortment (10 to 12 cultivars) against the majority of potato soil-borne pathogens inventoried until now in Tunisia. Furthermore, multi year studies (2008-2010) are actually undertaken for the assessment of comparative susceptibility of 34 potato cultivars to the late blight disease (*Phytophthora infestans*) for at least two growing seasons per year. Moreover, 9 clones issued from TPS (True Potato Seeds) trials were tested against pink rot, leak and dry rot agents. Some 'Fakous' (*Cucumis melo* L.) lines already selected for their resistance to powdery mildew were tested for their behaviour towards FOM reference strains and compared to most commercialized control melon cultivars.

Due to their soil-borne origin, wilting agents *V. dahliae* and *F. oxysporum* f. sp. *tuberosi* were tested for their synergistic interactions with the root knot nematode *Meloidogyne incognita* i.e. disease complex (third disease component i.e. biotic

environmental factor). This study was performed within the multinational project NEMATUS. The aggressiveness of both fungi was shown to be increased by 41% in presence of the nematode and enhanced nematode development (galling index) and reproduction (number of egg masses and female fecundity) were observed within bipartite and tripartite complexes including mainly *V. dahliae*.

Certain abiotic factors (i.e. third disease component) were also studied for their effects on pathogen aggressiveness and consequently, disease severity such as saline water for tomato Fusarium and Verticillium wilt agents, and temperature for potato tuber rots agents (*Fusarium* spp., *Pythium* spp., *Phytophthora erythroseptica*, *Sclerotium rolfsii*). In fact, both tomato wilt diseases showed increased severity under saline conditions leading to a reduced plant growth and a subsequent yield loss. However, studies of temperature × post-harvest potato pathogens interactions gave additional information concerning the thermic optima of their aggressiveness i.e. increased rots severity during storage.

Because of limits of genetic control i.e. absence of resistant plant material against the parasitic complexes (of species, *formae specialis* and/or physiological races) of major diseases studied, research activities were also focused on chemical control as no registered fungicides were available for their control even that several other pests were controlled chemically in conventional agriculture systems (late blight, grey mold, powdery mildew, cereal diseases, insects, etc). In fact, the efficacy of several fungicides was assessed against all the abovementioned potato pathogens (excepting *Phytophthora infestans*) and tomato wilts agents. Chemical control studies focused on Fusarium dry rot agents revealed, for the first time in Tunisia, the presence of *F. sambucinum* isolates resistant to Benzimidazoles fungicides even that this fungicide family was not used for potato treatment in Tunisia.

Nevertheless, belonging to a research center charged partly of organic agriculture, major activities were concentrated on biological control. In fact, the biocontrol of soil-borne pathogens studied was achieved using several means. Antagonistic fungi such as *Trichoderma harzianum*, *T. viride*, *T. virens*, *Gliocladium roseum* and *G. catenulatum* issued from diverse origins (soil, rhizosphere, compost, healthy plants i.e. endogenous fungi) were successfully used against *Verticillium* spp. on potato and tomato, FORL on tomato, and against the majority of the other potato pathogens under controlled and/or under field conditions. Compost microorganisms were also explored for the biocontrol of soil-borne pathogens as is the case of several *Aspergillus* species (*A. niger*, *A. flavus*, *A. nidulans*), *Penicillium* sp., *Trichoderma* spp., and bacteria belonging to the genera *Bacillus*, *Chryseomonas*, *Serratia* and *Aeromonas*. Promising results were obtained against *Fusarium* spp., *Pythium* spp., RS, FORL, SR, and VD especially when antagonists were applied prior pathogen inoculation. Their main mechanisms of action are resumed to mycoparasitism (*Trichoderma* spp. and *A. niger* and *A. flavus*), mycelium lysis (all antagonists tested), formation of mycelial cords (stress reaction), secretion of volatile compounds with antifungal activities (*Trichoderma* spp., *Penicillium* sp. and *Aspergillus* spp.), antibiosis (*Aspergillus* sp. and *Penicillium* sp.) and induced plant resistance confirmed via histopathological studies and/or enhanced plant growth (*Trichoderma* spp., *Gliocladium* spp. and *Aspergillus* spp.).

Plant extracts and essential oils of several aromatic indigenous plants were also tested for their antifungal activity against some fungal species where the essential oil of *Ruta chalepensis* (Rutaceae) showed antifungal properties against *Trichoderma viride* whereas *Thymus hirtus* Willd (Lamiaceae) essential oil inhibited *Aspergillus niger* and *Alternaria solani* growth. Moreover, as part of NEMATUS project works, nematophagous fungi including those causing egg mortalities were isolated from naturally infested egg masses of *Meloidogyne* sp. and/or soil. They were individually tested *in vitro* (dual culture with nematode eggs) and *in vivo* under controlled conditions on tomato plants artificially infested with *M. incognita*. Their efficacy was estimated *in vitro* based on hatching percentage of eggs incubated and parasitism, and *in vivo* via the galling index and some plant growth parameters. Promising results were obtained with *Pochonia chlamydosporia*, *Lecanicillium lecanii*, *Paecilomyces* sp., unidentified *Verticillium* species and *T. harzianum*.

In this first issue on *Tunisian Plant Science and Biotechnology*, researches highlighted mainly on the use of indigenous material (plant material i.e. rootstocks, breeding lines, antagonists, insect predators, compost) for the enhancement of plant production and/or the reduction of yield losses on some crops in Tunisia. Some works emphasised on different methods and criteria for 1) a rapid assessment of susceptibility/tolerance to some pathogens (olive response to *Pseudomonas savastanoi* filtrates), 2) monitoring and understanding of conditions leading to the development of some insect pests (*Frankliniella occidentalis*) or weed plants (*Cyperus rotundus*), 3) the evaluation of the nutritional value or quality of certain plant products (tomato and watermelon) and 4) other agronomic characteristics (related to potato dormancy and sprouting).

Nevertheless, heavy losses were reported on different crops (i.e. watermelon, tomato, rose, pear) production due to fungal diseases (wilts and crown and root rots), invasive insects (*Tuta absoluta*) and emergent pathogens (*V. tricorpus* on potato). Thus, as no approved fungicides/insecticides were available to control these fungal diseases and emergent pests, the use of tolerant or resistant rootstocks (as done for watermelon and pear), the biological control (with indigenous antagonists for tomato Verticillium wilt, predators for *Frankliniella occidentalis* on rose, and compost) could help in the improvement of plant growth and reduction of disease incidence and subsequent yield losses. Moreover, monitoring of the invasive insect species *Tuta absoluta* with pheromone traps had permitted to determine its population dynamics for programming the appropriate period of interventions and to estimate the expected yield loss.

Agriculture in Tunisia: A Conflict between Resources and Climate

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In North Africa, and especially in Tunisia, the population life is very bound to climate and its fluctuation. Agriculture in Maghreb region (North Africa) is the main use of both, land in term of area and water in term of consumption.

The geographic position of Tunisia between the tempered regions of the Northern Hemisphere and the inter-tropical regions confer to its climate a special variability. Independently of climate changes, as the most Mediterranean countries, Tunisia already suffers from climatic variability. Arid to semi-arid climate make up 75% of the total area of Tunisia, and periodic droughts and sporadic rainfall often jeopardize the harvests.

Recurrent droughts episodes often affect entire countries over multiyear periods and can result in serious social problem caused by water scarcity. The agriculture sector has been identified as the most vulnerable sector to climatic change in all Maghreb countries where it plays an important economic and social role. Hard climatic conditions which could negatively influence socio-economic development pushed the Tunisia government to set up a management strategy of available resources. The strategies consist in managing in an optimal way all available resources in order to allow for a sustainable development.

Tunisia receives yearly by mean of 36 billion m³ precipitation. Otherwise, the global water resources are about 4.8 billion m³, divided to 2.7 billion m³ as surface water and 2.1 billion m³ ground water. Next to water scarcity, Tunisia is also confronted with poor water quality since most of the water resources salinity exceeds the international health and agronomic standards (50% of the resources with salinity less than 1.5g/l and more than 30% with a salinity exceeding 4 g/l).

The agriculture sector constitutes the most water consumer with 83% of total available resources. The Volume of water used for irrigation is estimated to 2.100 million m³, with an average consumption per hectare of approximately 5500 m³/year.

The irrigated areas occupy only 10% of total cultivated areas and water deficit and drought represent a permanent risk for rainfed agriculture which occupies the majority of the agricultural areas. The production is very variable and is highly correlated with rainy events.

The main agriculture products are: olive oil, citrus fruits, cereals and dates. The most important speculations undertaken under rainfed conditions are firstly cereals followed by fruit crops and principally olive trees.

Cereals were considered as one of the most important sectors of Tunisian economy. In addition, for the government policy, cereals and mainly wheat are considered as a vital production. Cereals cover 30% of the total cultivated areas; however 97% were under rainfed conditions.

The olive tree is strongly present in the Tunisian landscape with 56 millions of trees, stretching over 1.6 millions ha. This tree, which spreads out all the country, from the north to the south under different bioclimatic conditions, constitutes also an important part of Tunisian agriculture and plays a leading socioeconomic role. The olive tree and its products became integral part of the daily life of the Tunisian, so material as spiritual.

In spite of the most part of the cultivated area (93%) is rainfed, the small part of the irrigated areas (<8%), constitute an important pillar of agriculture economy. It provides 35% of the production, 20% of the exportation (of the agriculture sector) and 27% of the workforce.

In addition, it plays a social role by decreasing the exodus and by providing a regular income equivalent to 3 times the rainfed income.

Predictions estimate that by 2025, the population in Tunisia will reach 13.5 millions and it could have a downturn in natural resources (water, soil, forest...).

According to the national strategy of adaptation (notebook 2), the climate modifications in Tunisia will have serious consequences on water resources, ecosystems and agrosystems mainly on olive and cereals sectors.

Tunisia is among the 17 countries which will be in situation of "absolute rarity" of resources in water by 2025. The most important consequence is that the country, which is also very sensitive to climatic variations, will not have enough water to maintain the same level of agricultural production irrigated by living, and to satisfy demand in drinking, industrial water, and the necessities of ecosystems. The adaptation capacity to predicted climate change is a real challenge for Tunisian agriculture, as it is confronted with development pressure, the population increasing and limited resources.

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Special Issue: Tunisian Plant Science and Biotechnology I (Guest Editor: Mejda Daami-Remadi, Centre Régional des Recherches en Horticulture et Agriculture Biologique, Chott-Mariem, Tunisia)

Riadh Ilahy, Chafik Hdider, Imen Tlili (Tunisia) Bioactive Compounds and Antioxidant Activity of Tomato High Lycopene Content Advanced Breeding Lines (pp 1-6)

ABSTRACT

Original Research Paper: In Tunisia, tomato (*Lycopersicon esculentum* Mill.) is the main 'vegetable' grown and consumed all year round and is therefore of strategic importance. Tomato fruits are becoming then an important source of natural antioxidants primarily lycopene, phenolics and vitamin C, which are involved in inhibiting reactive oxygen species responsible for many cancer and cardiovascular diseases. Breeding for high nutritional tomato value is becoming an increasingly important aim. In this context, tomato high lycopene content advanced breeding lines (HLT-F51 and HLT-F52) were evaluated for their total carotenoid, lycopene, total phenolics, flavonoids, ascorbic acid, dehydroascorbic acid as well as their hydrophilic and lipophilic antioxidant activities, compared to the variety Rio Grande commonly grown in Tunisia. All tested high lycopene content varieties showed generally satisfying agronomic characteristics. The total carotenoid, lycopene, total phenolics, flavonoids, dehydroascorbic acid, total vitamin C and hydrophilic and lipophilic antioxidant activities in tomato fruit varied significantly between the studied varieties. Compared to the control, the selected line HLT-F51 showed 2.65-, 2.62 and 3.57-fold higher total carotenoid, lycopene and flavonoids, respectively. Also, HLT-F51 showed 2.09 and 2.24-fold higher hydrophilic and lipophilic antioxidant activities respectively. HLT-F52 exhibited particularly higher dehydroascorbic acid and total vitamin C contents compared to the control variety Rio Grande. These results emphasize the promising use of such advanced breeding lines for healthy quality products.

Imen Tlili, Chafik Hdider, Riadh Ilahy, Hager Jebari (Tunisia) Assessing Agronomic Characteristics and Physicochemical Properties of Selected Watermelon Varieties Grown in Tunisia (pp 7-11)

ABSTRACT

Original Research Paper: Watermelon (*Citrullus lanatus* (Thunb.) Mansfeld) is a popular vegetable. Interest in assessing agronomic and bioactive compounds with antioxidant capacity and potential health benefits in watermelon is increasing. Besides some agronomic characteristics, the variability of lycopene and total phenolic contents of six watermelon varieties (four commercial cultivars 'Aramis', 'Crimson Sweet', 'Dumara', 'Giza', and two new selections P503 and P403 developed by the National Agricultural Research Institute of Tunisia) as influenced by sampling area was determined. 'Giza' and P503 were characterized by small fruits with a thin rind and a relatively high amount and large seeds. Significant differences were found in lycopene and phenolic contents between watermelon varieties. Lycopene content in P503 and 'Giza' was more than 2-fold higher than that in 'Dumara' and P403. The highest phenolic value (90.28 mg GAE kg⁻¹ FW) was shown by 'Dumara'. The lycopene and total phenolic contents varied significantly between studied sampling areas but not in all varieties. Generally, highest values for lycopene and total phenolics were obtained for heart and stem end areas. For all studied watermelon varieties, lycopene was best correlated with rind thickness and 100-seeds weight. This study demonstrates that the amount of lycopene and total phenolics were both influenced by genotype and sampling area, emphasizing the need to adopt standardized and documented sampling methods when assessing quality attributes, and to evaluate watermelon biodiversity in order to improve its nutritional value.

Mahmoud M'Hamdi, Hela Beji (Tunisia), Lassaad Belbahri (Switzerland), Taoufik Bettaieb, Karima Kouki, Youssef Harbaoui (Tunisia) Hydrogen Peroxide and a Catalase, Physiological Regulators of Potato (*Solanum tuberosum* L.) Tuber Dormancy (pp 12-15)

ABSTRACT

Original Research Paper: The involvement of hydrogen peroxide (H₂O₂) metabolism and catalase activity in dormancy release and sprouting of potato (*Solanum tuberosum* L.) tubers has been investigated in nine cultivars with a contrasting dormancy length. Phenotypic characterisation of tubers dormancy was established for all cultivars by following sprouting kinetics (percent of sprouted tubers following time during storage period). Catalase (CAT) activity and H₂O₂ content were measured during two important tuber physiological stages: dormancy and sprouting. Our results revealed three groups of cultivars according to the

length of dormancy: 'Arinda', 'Santana', and 'Safrane', with short dormancy (7-8 weeks), 'Mondial', 'Atlas', and 'Liseta', with long dormancy (15-16 weeks) and 'Spunta', 'Tango', and 'Nicola', with intermediate dormancy (12-13 weeks). 80% of cultivars with short dormancy sprouted between the 5th and 6th week after harvest, between the 9th and 10th week for the second group with intermediate dormancy and between the 12th and 13th week for the cultivars with long dormancy. Biochemical characterisation showed CAT activity and low H₂O₂ content during the dormancy stage for all cultivars. CAT activity varied between 30 and 18.57 $\mu\text{mol H}_2\text{O}_2 \text{ min}^{-1} \text{ mg}^{-1}$ of protein for 'Atlas and 'Nicola, respectively. For H₂O₂, the values ranged between 5.1 and 16.92 mmol (gFW)^{-1} in 'Tango', and 'Liseta', respectively. Sprouting was associated with a significant increase in H₂O₂ content (85.35 in 'Arinda', and 172.5 $\text{mmol g}^{-1} \text{ FW}^{-1}$ in 'Santana') and a decrease of CAT activity (5.09 in Tango and 13.15 $\mu\text{mol H}_2\text{O}_2 \text{ min}^{-1} \text{ mg}^{-1}$ of protein in 'Satana'.

Amel Kerkeni, Neji Tarchoun, Mohamed Ben Khedher (Tunisia) Animal Manure Composts as Potting Media for Production of Pepper (*Capsicum annuum*) Transplants (pp 16-19)

ABSTRACT

Short Communication: Different types of growing media were evaluated in nursery-produced peppers plants (*Capsicum annuum* L. cv. 'Rouge Long'). Five local composts (C1, C2, C3, C4 and C5), based on animal-manures (chicken, sheep, cattle and horse manure), used alone or in mixture with commercial peat (PT) were tested in this study. A control of 100% PT was compared to PT: compost mixtures at 50: 50 (v/v) and to 100% compost. Various seedling parameters were measured in order to assess the quality of the nursery-produced plants. The carbon: nitrogen ratio (C/N) of the medium decreased considerably as the level of compost increased, while pH increased. Electrical conductivity of all media was high ($>3 \text{ dS.m}^{-1}$). Despite the quality of the composts used (pH and salinity), growth in media consisting of composts, used at 100% or in a 1: 1 mixture with PT, was more acceptable (stem length and plant dry matter) than growth in peat alone. Although the five composts had different composition, they performed relatively similarly as potting media. No significant difference was observed between seedlings grown in 100% compost and those grown in 50% compost: 50% peat. 100% mature animal-manure composts were horticulturally acceptable as alternatives to 100% peat for pepper transplant production.

Nouha Hibar-Beji, Mejda Daami-Remadi, Khaled Hibar, Mohamed El Mahjoub (Tunisia) Effect of Substrate Culture on the Development of Fusarium Crown and Root Rot of Tomato (pp 20-23)

ABSTRACT

Original Research Paper: Fusarium crown and root rot of tomato is a new damaging disease of tomato plants in Tunisia. A study of the effect of culture substrate on the development of this disease revealed that *Fusarium oxysporum* f. sp. *radicis-lycopersici* (Forl) is highly virulent when tomato plants are transplanted to sand, topsoil or perlite. Adding compost to these substrates significantly reduced the expression of this pathogen. Indeed, disease incidence measured in a mixture of perlite and compost was only about 6.6%; however this value exceeded 43% when tomato plants were transplanted only to perlite. These results suggest the suppressive effect of compost on the development of Forl and on soil-borne pathogens in general.

Hayfa Jabnoun-Khiareddine, Mejda Daami-Remadi (Tunisia), Dez Barbara (UK), Mohamed El Mahjoub (Tunisia) First Report of *Verticillium tricorpus* from Potato Tubers and Plants in North Africa (pp 24-25)

ABSTRACT

Research Note: In field surveys in the potato growing areas in Tunisia, a dry rot of potato tubers cv. 'Spunta' was observed at harvest but at a low frequency (2%) compared to the other typical dry rots caused by *Fusarium* spp. Based on macroscopic and microscopic characters of the collected isolates, the fungus was identified as *V. tricorpus*. This fungus was also isolated from many wilted potato plants, alone or together with *V. dahliae*. Pathogenicity tests were performed on wounded and unwounded potato cv. 'Spunta' tubers and on plants. A dry rot was observed on wounded inoculated tubers and moderate but typical Verticillium wilt symptoms were occasioned on inoculated plants within 30 days of incubation. Some of the collected isolates grown on PDA amended with benomyl at different rates (0, 0.1, 1, 10 and 100 mg/l), 10 were resistant to benomyl as their minimum inhibitory concentration was greater than 10 mg/l.

Hayfa Jabnoun-Khiareddine, Mejda Daami-Remadi, Fakher Ayed, Mohamed El Mahjoub (Tunisia) Biological Control of Tomato Verticillium Wilt by Using Indigenous *Trichoderma* spp. (pp 26-36)

ABSTRACT

Original Research Paper: Three endogenous *Trichoderma* species were tested *in vitro*, *in vivo* and *in situ* for their antagonistic activity against *Verticillium* spp. causing tomato vascular wilt in Tunisia. *Trichoderma harzianum*, *T. viride* and *T. virens* isolates reduced the radial growth of *V. dahliae*, *V. albo-atrum* and *V. tricorpus* in comparison to the untreated controls. Antagonistic potential of *Trichoderma* spp. against tested wilt agents showed intra- and inter-specific variations. Additionally to the sclerotization inhibitory activity and to the reduced abundance of resting structures of *Verticillium* spp. observed, comparatively to untreated controls, *Trichoderma* spp. isolates caused profound alterations of *Verticillium* spp. mycelium at the confrontation zone. The germination of *V. dahliae* microsclerotia, exposed for 30 min to liquid cultures of antagonists tested and incubated at 20°C, was completely suppressed compared to the control microsclerotia treated with sterile distilled water. Furthermore, germinating microsclerotia dual cultured with *Trichoderma* spp. became unable to germinate and mature microsclerotia progressively lost their typical dark colour. All tomato cv. 'Ventura' plants, when treated at planting with a *Trichoderma* spp. spore suspension and inoculated with *V. dahliae*, showed after 60 days of culture under growth chamber conditions, a reduced severity of *Verticillium* wilt in comparison to inoculated and untreated control plants. In addition, plants treated with *Trichoderma* spp. showed increased height and root and stem fresh weights in comparison to the inoculated and untreated control. The discoloration index, noted on tomato plants treated at planting by *T. harzianum*, *T. viride* and *T. virens* and grown under greenhouse conditions, was significantly reduced compared to the untreated control. Plants treated with *Trichoderma* spp. showed, after 90 days of culture, an increase of more than 50% of their roots and stem fresh weights in comparison to the untreated control.

Ziad Borgi, Khaled Hibar, Naima Boughalleb, Hajer Jabari (Tunisia) Evaluation of Four Local Colocynth Accessions and Four Hybrids, Used as Watermelon Rootstocks, for Resistance to Fusarium Wilt and Fusarium Crown and Root Rot (pp 37-40)

ABSTRACT

Original Research Paper: Fusarium wilt and Fusarium crown and root rot, caused by *Fusarium oxysporum* f. sp. *niveum* and *F. solani* f. sp. *Cucurbitae*, respectively are damaging diseases of watermelon in Tunisia. While causing heavy losses to watermelon production, no or some effective disease control methods are available. In Tunisia, there are no approved fungicides to control these diseases. The use of tolerant or resistant rootstocks seems to be the most effective measure. Using local colocynth accessions seems to be a reliable solution for controlling Fusarium wilt and Fusarium crown and root rot. Indeed, the percent of diseased plants did not exceed 8.6%. Used as parental accessions and hybridized with *Citrullus lanatus* var. *citroides*, they generated resistant hybrids whose percentage of diseased plants was no more than 8.3%. These results suggest that colocynth accessions as well as the generated hybrids seem to be potential watermelon rootstock that can be used in Tunisian orchards where *Fusarium* species cause problems.

Hechmi Mehri, Raoudha Mehri-Kamoun, Khaled Hibar (Tunisia) *In Vitro* Evaluation of Resistance of *Pyrus syriaca*, a Pear-tree Rootstock, to Phytophthora Crown Rot (pp 41-43)

ABSTRACT

Research Note: Phytophthora crown rot, caused by *Phytophthora cactorum*, is a damaging disease of apple, peach and plum in Tunisia. While causing heavy losses to fruit production, no or some effective disease control methods are available. In Tunisia, there are no approved fungicides to control *P. cactorum*. The use of tolerant or resistant rootstocks seems to be the most effective measure for controlling Phytophthora crown rot. *Pyrus syriaca*, a pear-tree rootstock, was tested for resistance to *P. cactorum*, demonstrating high resistance to this pathogen. Indeed, on excised twigs, the necrotic length ranged between 1.22 and 0.67 mm. However, this value varied between 12 and 15 mm for Myrandier 617, known to be sensitive to *P. cactorum*. In *in vitro* experiments, the percentage of necrotic plants varied between 1.8 and 1.9% for the rootstock *P. syriaca*. These values were almost equal to those obtained with GF 667. However the percentage of necrosis *in vitro* plants obtained with Myrandier 617 varied from 86.2 to 95.2%. These results suggest that *P. syriaca* seems to be a potential pear-tree rootstock that can be used in Tunisian orchards where *P. cactorum* causes problems.

Hechmi Mehri, Raoudha Mehri-Kamoun, Khaled Hibar (Tunisia) Response of 'Ousleti' Olive Pollen to *Pseudomonas syringae* pv. *savastanoi* Culture Filtrate (pp 44-48)

ABSTRACT

Original Research Paper: Olive knot is the only bacterial disease of the olive tree, caused by *Pseudomonas syringae* pv. *savastanoi* L. The most effective measure for controlling this bacterial disease is the use of resistant cultivars because chemical control is not effective. 'Ousleti', an important local olive cultivar in Tunisia, is reported to be resistant to this bacterial disease although there is no scientific study to prove this. In this preliminary study, the effect of a toxic culture filtrate of *P. savastanoi* on pollen germination and pollen tube growth was evaluated *in vitro* on two Tunisian olive cultivars; one tolerant 'Ousleti' and one susceptible 'Chemlali'. The variety x treatment interaction was significant indicating that cultivars differed in their response to the treatment. Cultivar differences in the reaction of olive pollen to bacterial filtrate were noted. The addition of *P. savastanoi* culture filtrate to the germination medium had no significant effect on the percentage of pollen germination and the tube length in the tolerant olive cultivar 'Ousleti' in comparison to its control but they were highly reduced in the susceptible one, 'Chemlali'. In addition to inhibiting pollen germination and tube elongation in 'Chemlali', culture filtrate applied to culture medium also influenced tube morphology. Several abnormalities in pollen tube growth were observed when culture filtrate was added to germination medium of 'Chemlali' pollen. These results suggest that this tested method, based on pollen response, enabled rapid and effective evaluation of *P. savastanoi* on olive pollen grains then on olive resistance. Also, the percentage of pollen germination and tube growth in the presence of culture filtrate medium might be correlated with the plant's response to the pathogen.

Brahim Chermiti, Khaled Abbes, Mariem Aoun, Soukaina Ben Othmane, Mohamed Ouhibi, Wafa Gamoon, Sonia Kacem (Tunisia) First Estimate of the Damage of *Tuta absoluta* (Povolny) (Lepidoptera: Gelechiidae) and Evaluation of the Efficiency of Sex Pheromone Traps in Greenhouses of Tomato Crops in the Bekalta region, Tunisia (pp 49-52)

ABSTRACT

Original Research Paper: Monitoring *Tuta absoluta* with pheromone traps and weekly sampling in the Bekalta cropping area showed that the population dynamics of the insect on young tomato leaves can be separated into three phases: low infestation initially (from 25th March to 6th May, 2009), followed by a growing population with a dominance of eggs and of first instar larvae (from 6th May to 27th May, 2009), then a decline phase accompanied by progressive drying of tomato plants (from 27th May to 3rd June, 2009). Mass trapping in the experimental greenhouses was not efficient compared to the control. The study revealed that fruit losses do not depend on the presence or absence of a sex pheromone trap because all greenhouses in this biotope were not isolated from the external environment with an insect-proof which can prevent the entry of *T. absoluta* adults. Losses in 9 representative greenhouses were between 11.08 and 43.33% with an average deficit of 809 kg for an average total production of 4156 kg, corresponding to a 20% loss.

Mohamed Elimem, Brahim Chermiti (Tunisia) Population Dynamics of *Frankliniella occidentalis* Pergande (1895) (Thysanoptera: Thripidae) and Evaluation of its Different Ecotypes and their Evolution in a Rose (*Rosa hybrida*) Greenhouse in the Sahline Region, Tunisia (pp 53-62)

ABSTRACT

Original Research Paper: Monitoring population dynamics of *Frankliniella occidentalis* Pergand (1895) (Thysanoptera; Thripidae) employing blue sticky traps and the weekly collection of flowers allowed the determination of the critical periods of insect population increase in Tunisia, namely spring and early summer. Indeed, the maximum *F. occidentalis* population was recorded during June, while the lowest number of thrips was observed during winter. On the other hand, the observations revealed that the number of males decreased gradually compared to females mainly in summer with a proportional decrease in the sex ratio. On the other hand, a study of the occurrence of natural enemies associated with Californian thrips led to the identification of a predatory bug *Orius insidiosus* Say (1832) (Heteroptera: Anthocoridae) which was frequently observed in the sampled flowers. This predator declined *F. occidentalis* population 5 weeks after its natural introduction and installation into the rose crop greenhouse. Moreover, regular prospecting realized on 2007 in rose crop greenhouses in the Sahline region in Tunisia permitted to distinguish different ecotypes of western flower thrips *Frankliniella occidentalis* Pergand (1895) (Thysanoptera, Thripidae). Indeed, based on their color, three ecotypes were found: dark, pale yellow and intermediate color. The temporal evolution of these three ecotypes was studied depending on environmental conditions. In fact, the dark ecotype was shown to be mostly abundant during winter and spring and to decrease in summer but did not disappear. However, the pale yellow ecotype was completely absent during the cold season, appeared in spring and summer and dominated the western flower thrips population. The ecotype of intermediate color was present throughout the year without showing too much variation.

Abdessatar Omezine, Fethia Harzallah-Skhiri (Tunisia) Biological Behavior of *Cyperus rotundus* in Relation to

ABSTRACT

Original Research Paper: Field and laboratory experiments were conducted to study the biological behavior of *C. rotundus* over a two-year period (2006-2007). Spatial distribution, viability and tuber formation were investigated. The effect of propagule size, storage conditions, soil moisture and multiple tubers in rhizome chains on tuber sprouting of *C. rotundus* were determined. *C. rotundus* forms a large number of tubers per plant, 46% of which are able to sprout. However, 54% undergo dormancy. Distribution of tubers in the soil profile is most abundant in the 0-12 cm layer, accounting for 78.6% of all tubers but the depth can attain 40 cm and is expected to be deeper. In *C. rotundus*, the apical bud inhibits sprouting in other buds on the same tuber, and the top tuber exerts a similar dominance over the lower tubers in the system. The viability of tubers decreases in an inverse linear manner over an increasing range of burial depth. *C. rotundus* tubers are very sensible to desiccation. Moisture levels in the soil must increase to a critical level before sprouting occurs, but excess soil moisture deters sprouting. Tuber emergence and emergence time depend upon tuber size and burial depth. Systems to manipulate sprouting may provide new strategies for *C. rotundus* management.