



FUSARIUM GRAMINEARUM IN NORWEGIAN CEREALS. H.U. Aamot, I.S. Hofgaard, G. Brodal, O. Elen and S.S. Klemsdal. *Bioforsk-Norwegian Institute for Agricultural and Environmental Research, Plant Health and Plant Protection Division, Hogskoleveien 7, 1432 Aas, Norway. E-mail: sonja.klemsdal@bioforsk.no*

The last few years, increasing levels of DON (deoxynivalenol) have been recorded in Norwegian cereals, particularly in oats. In the same period, increased occurrence of *F. graminearum* has been reported in Norway as well as in the Western part of Europe. There may be several reasons for this change: Climate change, altered distribution of cereal cultivars, pathogen adaptation to cooler regions etc. We aim to clarify whether the increasing occurrence of *F. graminearum* in Norwegian cereals is connected to a change in the distribution of genotypes of this species. Fifty 'old' *F. graminearum* isolates collected from Norwegian grown cereals during the 1990s will be compared to a similar number of 'new' isolates collected in recent years (2005-2007). Isolates from Germany, Russia, Finland and the US will be used for comparisons. The genetic diversity of these about 110 isolates (50 'new', 50 'old' and 10 non-Norwegian isolates) will be investigated by AFLP (amplified fragment length polymorphism). These isolates will also be identified phylogenetically and characterised to chemotype. In addition, some selected isolates will be assessed for aggressiveness on wheat and specific characters potentially important for fungal distribution such as *in vitro* growth rate, spore production and perithecia formation.

SURVEY OF FUSARIUM spp. AND MICRODOCHIUM NIVALE POPULATION ON WINTER WHEAT IN FLANDERS. K. Audenaert¹, R. Van Broeck², F. Dewitte¹, M. Höfte², K. Messens¹ and G. Haesaert¹. ¹Department of BioSciences and Landscape Architecture, University College Ghent, Voskenslaan 270, 9000 Ghent, Belgium. ²Department of Crop Protection, Laboratory Phytopathology, Ghent University, Coupure Links, 653, 9000 Ghent, Belgium. E-mail: kris.audenaert@hogent.be

Head blight of wheat caused by various *Fusarium* spp. and *Microdochium nivale* (*Fusarium nivale*) can result in significant yield loss. Furthermore, *Fusarium* spp. can produce various mycotoxins such as deoxynivalenol (DON) and zearalenon (ZEA). Maximum levels for both mycotoxins have been set by the European Commission since the presence of these toxins can cause severe health problems in particular for pigs and chickens. The presence of *Fusarium* and mycotoxins is mainly the result of the infection of wheat plants by the pathogen in the field. This presence is favoured by recent agricultural practices such as reduced tillage, incorporation of crop residues and the increased importance of maize in culture rotation systems. In addition, *Fusarium* infections is also promoted by prolonged periods of rain during anthesis of the wheat plants. The objective of our study was to gain insight into the geographical composition of the *Fusarium* spp. population throughout Flanders. In 9 locations, corresponding to the major wheat growing areas in Flanders, 12 winter wheat races were grown under similar conditions in 3 biological repetitions and evaluated for *Fusarium* symptoms. In parallel, DON levels were measured using competitive ELISA. Finally, the population composition was characterized using species-specific PCR to distinguish the major *Fusarium* spp. and *M. nivale*. Results of this *Fusarium* survey will be presented and discussed.

FUSARIUM LEAF BLOTCH AND HEAD BLIGHT OF DURUM WHEAT AND ITS MANAGEMENT IN PUNJAB, INDIA. P.S.

Bagga. Punjab Agricultural University, Regional Research Station, Gurdaspur-143 521, Punjab, India. E-mail: psb_gsp@yahoo.com

Fusarium leaf blotch and head blight epidemics (caused primarily by *Fusarium nivale*) have occurred 4-5 times in the Punjab state of India since early 1990s and the most recent one occurred in 2005 when the most popular wheat cv PBW 343 (10-50% infected heads) and the durum wheat cv PDW 274 (>90% infected heads) were the worst affected. Due to its occurrence in a limited area, no breeding program has been initiated so far and alternative options such as host resistance, controlling wheat aphids and the use of fungicides are being explored for managing this disease. Whole plant resistance of the durum germplasm in the initial and advanced varietal trials was evaluated in replicated field trials during 2005 and 2006 seasons. Three durum wheat cvs WH 896, MPO 1192 and HD 4715, which had the same date of heading as the check cvs PDW 233 and PDW 291, had much lower FHB severity (4.39-8.84%) compared to 13.37-14.21%, respectively in the control. To investigate the role of wheat aphids in leaf blotch, a detached leaf assay on water agar in Petri dishes was used. Leaf segments (two leaf segments 5 cm each/dish) were infested in the center with a mixture of 10 aphid nymphs/leaf segment and a 5 mm mycelial disc of *F. nivale* and incubated at 20°C. *F. nivale* and aphids, when inoculated/infested simultaneously, or when aphid infestation followed 72 h later by *F. nivale*, resulted in significant increase in *Fusarium* lesion size, in comparison with *F. nivale* inoculated alone or *F. nivale* followed 72 h later by aphid, thus indicating the role of wheat aphids in FHB development.

INFLUENCE OF WATER STRESS ON THE DEVELOPMENT OF FOOT ROT CAUSED BY FUSARIUM CULMORUM IN THE DURUM WHEAT SEEDLING. S. Chekali¹, S.K. Gargouri², M.R. Hajlaoui² and B. Nasraoui¹. ¹Ecole Supérieure d'Agriculture du Kef, 7119 Le Kef, Tunisia. ²Laboratoire de Protection des Végétaux, Institut National de la Recherche Agronomique de Tunisie, Rue Hédi Karray, 2049 Tunis, Tunisia. E-mail: kamoun.samira@iresa.agrinet.tn

Foot and root rot is responsible of economic damages on wheat crops in Tunisia and the North African countries since this disease is favored by dry conditions. In this work, the relationship between water stress and the development of foot rot caused by *Fusarium culmorum*, the dominant species in Tunisia, was studied. For this purpose, emergence and disease severity were estimated in 6 durum wheat varieties after inoculation with *F. culmorum* and using 5 water stress levels. Emergence was affected in the inoculated plants of all varieties but varied significantly between varieties. Besides, the increase of water stress in the inoculated plants induced a decrease in the emergence compared to the non inoculated ones. Disease severity evaluated by the proportion of the discoloration of the seedling varied significantly between varieties and increased when water stress increased. These results suggest that water stress may increase the damage caused by the fungus on wheat.

PRESENCE OF MYCOTOXIGENIC FUNGI AND MYCOTOXINS IN WHEAT GRAIN IN UMBRIA (CENTRAL ITALY). L. Covarelli, G. Beccari and M. Quaglia. Dipartimento di Scienze Agrarie e Ambientali, Università degli Studi, Borgo XX Giugno, 74, 06121 Perugia, Italy. E-mail: lorenzo.covarelli@unipg.it

A three-year survey was carried out from 2004 to 2006 in order to evaluate the phytosanitary state and mycotoxin contamination



tion of wheat grain in the province of Perugia (Umbria, Central Italy). Soft and durum wheat samples were collected immediately after harvest and evaluated for the presence of *Fusarium* head blight (FHB) causal agents, both by traditional pathogen isolation on blotter and agar media (deep-freezing blotter, DCPA and PDA) and by molecular methods (PCR). The presence of deoxynivalenol (DON) and T-2 toxin, the most important mycotoxins of this crop, was determined by the ELISA immunoenzymatic method. The most frequent pathogens detected in wheat kernels were *Fusarium poae* and *F. sporotrichioides*. *Microdochium nivale*, *F. graminearum* and *F. equiseti* were also recorded at very low incidence. These results indicate a change in the relative composition of the FHB pathogens in the examined area, confirming what recently reported by other authors for wheat grain samples in other Italian regions. DON and T-2 mycotoxins were constantly present in the analyzed grain but at very low concentrations and largely below the EU limits.

AETIOLOGY AND EPIDEMIOLOGY OF *FUSARIUM* HEAD BLIGHT IN THE NORTHERN GRAIN BELT OF AUSTRALIA.

P.A.B. Davies and L.W. Burgess *Faculty of Agriculture, Food and Natural Resources, University of Sydney, NSW, Australia. E-mail: p.davies@camden.usyd.edu.au*

During a 2005 field survey following an epidemic of *Fusarium* head blight (FHB) of wheat, both *F. graminearum* and *F. pseudograminearum* were isolated from the rachis of FHB-affected stems across the Liverpool Plains in the northern grain belt of Australia. Both crown rot (CR), caused by *F. pseudograminearum*, and FHB occur in this region. In fields where the incidence of CR was high, *F. pseudograminearum* was the dominant FHB pathogen. *F. pseudograminearum* was commonly recovered following the repeated cropping of susceptible winter cereals. In contrast, *F. graminearum* was recovered at high levels even under farming systems that included rotation to non-hosts, long fallowing and cultivation. Therefore, while rotation to non-hosts limited the incidence of FHB caused by *F. pseudograminearum*, it did not appear to affect FHB caused by *F. graminearum*. This suggests that farming systems have an impact on the relative importance of these pathogens. Furthermore, despite the recovery of *F. graminearum* from infected heads, perithecia were absent from residues in affected crops. However, abundant *F. graminearum* perithecia were present on maize residues in the vicinity of two of the survey sites. Long distance dispersal of *F. graminearum* ascospores as demonstrated in North America may explain the source of *F. graminearum* for the outbreak. Ascospore dispersal has not been studied in Australia. Such dispersal would have implications for FHB control, requiring regional inoculum management. Further work is being completed to assess the potential for, and impact of long distance dispersal of ascospores in Australia.

POPULATION STRUCTURE, CHEMOTYPE DIVERSITY, AGGRESSIVENESS ON TYPE-1, AND TYPE-2 RIL AND POTENTIAL CHEMOTYPE SHIFTING OF *FUSARIUM GRAMINEARUM* IN WHEAT FIELDS OF MANITOBA, CANADA. **W.G. Dilantha Fernando, M. Zhang, X. Guo and A. Brule-Babel.** *Department of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2, Canada. E-mail: D_Fernando@Umanitoba.ca*

Chemotype 3ADON is presumed to be more potent than 15ADON. Evidence was found that there has been a shift to the more potent mycotoxin derivative 3ADON in the prairies. An extensive study was undertaken from 2004 to 2006 covering all

wheat growing regions in Manitoba to investigate genetic and chemotype diversity, distribution and potential chemotype shifting of *Fusarium graminearum*. This study was conducted in farmers' fields sown to wheat cultivars Superb (susceptible to FHB) and AC Barrie (fair to FHB). Percentages of 3ADON and 15ADON chemotypes of *F. graminearum* (*Gibberella zeae*) ranged from 0% to 95.7%, and 4.3% to 100%, respectively. The 3ADON chemotype was mostly distributed in southern Manitoba. There was no 3ADON chemotype found in the two northern regions Kenville and Dauphin. Significant gene flow was found between sub grouped populations. Gene flow occurred between the populations close to or far from each other. There was a great variation of percentage of the 3ADON chemotype within the sub grouped population from different locations and regions, which could result from a high level of genetic diversity of *F. graminearum* populations. It is suggested that sexual recombination, population age and cropping system could be associated with genetic and chemotypic diversities of *F. graminearum* populations. Wheat seed shipment and long-distance spore transportation of *F. graminearum* likely contributed to the genetic migration between locations and regions; and potentially caused chemotype shifting in Manitoba. The aggressiveness of these isolates on RIL comprising Type-1 and Type-2 resistance to *F. graminearum* is under investigation and will be reported at the conference.

IMPROVED *IN VITRO* SEEDLING ASSAY FOR IDENTIFYING CROWN ROT (*FUSARIUM CULMORUM*) RESISTANCE ON WHEAT UNDER GREENHOUSE CONDITIONS. **G. Erginbas^{1,2}, E. Kinaci², J.M. Nicol¹, G. Poole³, T. Paulitz³, A. Yorgancilar⁴, E. Sahin^{1,5}, A.T. Kilinc⁴ and F. Ozdemir^{5,6}.** ¹CIM-MYT (*International Maize and Wheat Improvement Centre*) P.O. Box 39, Emek 06511, Ankara, Turkey. ²Faculty of Agriculture, Department of Field Crops, Osmangazi University, Eskisehir, Turkey. ³Washington State University Pullman, Washington, USA. ⁴Anatolian Agricultural Research Institute, Eskisehir, Turkey. ⁵Faculty of Agriculture, Department of Plant Protection, Cukurova University, Adana, Turkey. ⁶Babri Dagdas International Agricultural Research Institute, Konya, Turkey. E-mail: gul_erginbas@hotmail.com

Crown rot caused by *Fusarium* is a major biotic constraint in many rainfed wheat cropping systems of the world. *F. culmorum* is the dominant causal species in Turkey and has been found to cause yield losses of up to 43% on winter wheats. A large multi-factor experiment with 7 replicates was established investigating three different inoculation techniques (seedling dipping, stem base inoculation and grain colonization) using two pathogenic isolates of *F. culmorum* against known partially resistant (PR) bread wheat (Altay, 2-49) and 2 known susceptible (S) wheat checks (Durati durum, Seri bread) under controlled greenhouse conditions. After 8 weeks plants were harvested and the Crown and/or Root were given scores for disease browning a number of different rating methods including the Mitter *et al.* (*Plant Pathol.* **55**: 433-441, 2006), Wildermuth and Mc Namara (*Plant Dis.* **78**: 949-953, 1994) and Nicol *et al.* (In: Z. Bedo and L. Lang, eds., *Wheat in a Global Environment Proc. 6th Internatl. Wheat Conf.* 2000, Budapest 2000: 381-389, 2001). Results clearly indicated that the seedling dipping method > grain colonization > stem base inoculation with respect to pathogenicity and differentiating PR and S checks. All rating methods showed significant variety × inoculation method interaction and the two isolates were considered to be equally pathogenic. The Nicol *et al.* (2001) mean rating of combined roots and shoot scores and root only provided the clear differentiation of PR and R checks, more than other methods.

PATHOGENICITY OF TURKISH DRYLAND CROWN ROT ISOLATES (*FUSARIUM CULMORUM*) ON WHEAT UNDER GREENHOUSE CONDITIONS. G. Erginbas^{1,2}, E. Kinaci², J.M. Nicol¹, A. Yorgancilar³, E. Sahin^{1,4}, A.T. Kilinc³ and F. Ozdemir^{4,5}. ¹CIMMYT (International Maize and Wheat Improvement Centre) P.O. Box. 39, Emek 06511, Ankara, Turkey. ²Faculty of Agriculture, Department of Field Crops, Osmangazi University, Eskisehir, Turkey. ³Anatolian Agricultural Research Institute, Eskisehir, Turkey. ⁴Faculty of Agriculture, Department of Plant Protection, Cukurova University, Adana, Turkey. ⁵Babri Dagdas International Agricultural Research Institute, Konya, Turkey. E-mail: gul_erginbas@hotmail.com

Crown rot caused by *Fusarium* is a major biotic constraint in many rainfed wheat cropping systems of the world. *F. culmorum* is the dominant causal species in Turkey and has been found to cause yield losses of up to 43% on winter wheats. Fourteen representative *F. culmorum* isolates from Turkish wheat growing regions were assessed for their pathogenicity on bread wheat under controlled greenhouse conditions using the modified screening method of Mitter *et al.* (*Plant Pathol.* 55: 433-441, 2006). Eleven isolates were from crown tissues, one from head and the other 2 unknown. The 14 isolates and a control were assessed in a RCBD with 6 replicates against two known partially resistant (PR) bread wheat (Altay, 2-49) and 2 known susceptible (S) wheat checks (Durati durum, Seri bread). Plants were harvested 8 weeks post inoculation and the crown and the root were given scores for disease browning. A highly significant ($P < 0.001$) variety x isolate interaction was found, where isolates were found to give a range of differential reactions in their pathogenicity on the varieties. There was a significant correlation ($R=0.76$) between root and crown scores, inferring only crown score was necessary to record. Isolate 5 was found the most pathogenic producing high scores and the greatest variation between the PR and S checks, whilst 9 and 11 were not pathogenic. The head scab isolate was found to be highly pathogenic in producing crown rot. The conclusion of this work is pathogenicity studies are essential to identify the most appropriate isolate(s) for conducting resistance screening.

EPIDEMIOLOGY AND INTERACTION OF *FUSARIUM MANGIFERAE* WITH THE BUD MITE, *ACERIA MANGIFERAE*, IN MANGO MALFORMATION DISEASE. E. Gamliel-Atinsky^{1,2}, E. Palevsky³, A. Szejnberg², D. Shteinberg¹, Y. Denisov^{1,2}, M. Maymon¹, E. Belasov⁴ and S. Freeman¹. ¹Department of Plant Pathology, ARO, The Volcani Center, Bet Dagan 50250, Israel. ²Department of Plant Pathology and Microbiology, The Hebrew University of Jerusalem, Faculty of Agricultural, Food and Environmental Quality Science, Rehovot 76100, Israel. ³Department of Entomology, Neve-Ya'ar Research Center, ARO, Ramat Yishay 30095, Israel. ⁴Microscopy Unit, ARO, The Volcani Center, Bet Dagan 50250, Israel. E-mail: freeman@volcani.agri.gov.il

Mango malformation caused by *Fusarium mangiferae* is one of the most destructive diseases of this crop worldwide. Epidemiology of disease, conidial dispersal patterns, location of penetration sites, colonization in the tree and interaction with the mango bud mite, *Aceria mangiferae*, are all poorly understood although the disease has been studied for over 120 years. Mango apical buds were found to be exclusive penetration sites. Following mite exposure to a *gfp*-marked isolate, conidia were observed clinging to the mite's body. Conidia were isolated from bud bracts only when both mites and conidia were co-inoculated on leaves, demonstrating mite-vectoring of conidia into apical buds. Incidence and severity of infected buds were significantly higher in the presence of mites indicating their role in the infection process. Conidia and

mite presence were monitored in a diseased orchard. Significantly more conidia/g infected panicles were found in May and June than in April during 2004-07, corresponding with panicle maturation and dispersal of inoculum. No windborne bud mites bearing conidia were found in mite traps; however, airborne conidia were isolated from Burkard spore traps and plates with selective media in the orchard. This suggests that *A. mangiferae* can carry and vector the pathogen into apical buds, assist in fungal penetration, but does not appear to be involved in aerial dissemination of conidia. Furthermore, this study suggests that understanding the epidemiology of the pathogen may assist in developing an improved control program for mango malformation disease.

POST INOCULATION MOISTURE IMPACTS DEOXYNIVALENOL ACCUMULATION IN *FUSARIUM GRAMINEARUM* - INFECTED WHEAT. P. Gautam and R. Dill-Macky. Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108, USA. E-mail: ruthdm@umn.edu

Field experiments were conducted to examine the effect of moisture on the production and accumulation of deoxynivalenol (DON) in *Fusarium*-infected wheat. Experiments were split-split-plot designs [main plot: days (14, 21, 28 and 35 d) of mist-irrigation after inoculation (DAI); sub-plot: wheat cultivars (n=3); sub-sub-plot: *Fusarium graminearum* isolates (n=5)] with five replications. The isolates differed for relative aggressiveness (greenhouse tests) and DON production (grain culture). Two-rowed plots of the cultivars Alsen (moderately resistant, Sumai 3-derived), 2375 (moderately susceptible) and Wheaton (susceptible) were inoculated at the anthesis and 3DAI with *F. graminearum* (1×10^6 macroconidia ml⁻¹). Mist-irrigation treatments were started immediately following the inoculation. Disease was assessed visually 21 DAI on 20 heads per plot. Grain was harvested at maturity. The percentage of visually scabby kernels (VSK) and DON was determined on a 25 g sub-sample of grain. FHB severity, VSK, and DON, across all isolates, were significantly higher in the susceptible cultivar Wheaton than either Alsen or 2375. FHB severity and VSK were significantly lower in the treatments receiving the least amount of mist-irrigation (14 DAI) than for treatments receiving additional mist-irrigation, suggesting that extended periods of moisture promote disease development. However, DON was significantly lower in the longest mist-irrigation treatment (35 DAI) compared to other treatments. This suggests that DON may be reduced by late season moisture despite increasing colonization of the grain. Reduced DON production or leaching of DON from plant tissues toward harvest may explain the observed reductions in DON.

INCIDENCE AND BIODIVERSITY OF *FUSARIUM* SPECIES CAUSING EAR ROT OF MAIZE IN GERMANY. A. Görtz¹, E.C. Oerke¹, U. Steiner¹, C. Waalwijk², P.M. de Vries² and H.W. Dehne¹. ¹Institute of Crop Science and Resource Conservation, Phytomedicine, Nussallee 9, 53115 Bonn, Germany. ²Plant Research International BV, Business Unit Biointeractions and Plant Health, Droevendaalsesteeg 1, 6700 AA Wageningen, The Netherlands. E-mail: agoertz@uni-bonn.de

In Germany, maize is one of the most important agricultural commodities produced, an essential component in animal feed as well as an elementary substrate in biogas production. Ear rot of maize poses a major impact worldwide as it is caused by several *Fusarium* spp., most of which have the ability to produce mycotoxins. Despite of the ongoing expansion of the maize acreage in next years, insufficient information is available concerning the

impact of *Fusarium* ear rot in Germany. Therefore, in 2006 and 2007 kernel maize was sampled throughout Germany to determine the natural severity of *Fusarium* ear rot and to identify the biodiversity of the *Fusarium* species. In 2006, the frequency of kernels infected by *Fusarium* spp. ranged from 0.6% to 99.6%; the average incidence was 34.9%. Thirteen different *Fusarium* species were isolated from maize kernels, in which *F. verticillioides*, *F. graminearum* and *F. proliferatum* were the predominant species. In 2007, the highest incidence of *Fusarium* ear rot was 64%; with a mean level of infection of 18.8%. *F. graminearum* was by far the most frequent species isolated from all sampled fields in 2007. In addition, *F. crookwellense*, *F. subglutinans* and *F. avenaceum* were frequently encountered. In particular, the fumonisin-producing species *F. verticillioides* and *F. proliferatum* were less frequent than in 2006. The year-to-year variability in the frequency of *Fusarium* species and the overall infection rate may be explained by significant differences in temperature and precipitation during the growth periods.

WILT DISEASE CAUSED BY *FUSARIUM REDOLENS* ON LENTIL. A. Haegi, M. Valvassori, G. Di Giambattista and L. Riccioni. CRA, Centro di Ricerca per la Patologia Vegetale, Via C.G. Bertero 22, 00156 Rome, Italy. E-mail: luca.riccioni@entecra.it

Lentil (*Lens culinaris* Medik.) is an old traditional crop in Sicily (Italy), especially in the area of Villalba (Caltanissetta) were a local landrace named "Lenticchia di Villalba" is grown. Vascular wilt is one of the main disease problems of this landrace. *Fusarium oxysporum* f. sp. *lentis* Vasud. and Sriniv. (FOL) is the only *Fusarium* species known till now to cause lentil wilt worldwide. It is a soil-borne fungus which can infect plants throughout the growing season and causes severe grain losses until complete failure of the crop, especially when a warm spring is followed by a dry hot summer. No physiological races of the pathogen have been reported. In this study six isolates obtained from soil and affected plants of "Lenticchia di Villalba" growing area and four FOL isolates, coming from other lentil Mediterranean areas, Syria and Algeria, were analysed. Morphological, cultural and molecular (sequences of the rDNA ITS regions and the elongation factor EF-1 α) characteristics were determined. Four of the isolates analysed were identified as *F. redolens* Wollenw., including the two isolates previously identified as FOL coming from Syria. Pathogenicity test confirmed that *F. redolens* can be considered a new pathogen on lentil causing wilt symptoms, with a comparable aggressiveness to Sicilian FOL isolates. A RFLP marker was setup to rapidly discriminate the two *Fusarium* species. It was used to evaluate the incidence in a population of isolates obtained from infected plants and from the soil of the Villalba lentil growing area. Among the 79 isolates analysed 49% resulted to be *F. redolens*.

***FUSARIUM* SKIN AND NAIL INFECTIONS: UNDERESTIMATED PATHOLOGY?** H. Harak and T. Saporito. Ospedale di Sesto San Giovanni, Viale Matteotti 83, 20099 Sesto San Giovanni, MI, Italy. E-mail: henry.harak@aovimercate.org

Fusarium spp. are known agents of onychomycosis, paronychia, keratitis with endophthalmitis, foot intertrigo, cellulitis and mycetoma. In addition they are considered as emerging human fungal pathogens, giving severe systemic disease in immunocompromised patients. In recent years the incidence of *Fusarium* pathology is doubling and resulted the predominant fungi in eye infections. Nevertheless, still many physicians (specialists included), when dealing with immunocompetent patients, consider the

Fusarium spp. isolation as contaminants or opportunistic, without any clinical relevance. Considering *Fusarium* spp. as opportunistic rather than facultative pathogens is misleading and unrealistic, because they show more virulent potential *in vitro* and *in vivo* than many of usually considered pathogenic fungi. However they seem to be less adapted to cause human infection in comparison with some anthropophilic dermatophytes. *Fusarium* skin infections and especially *Fusarium* paronychia (a variant of *Fusarium* cellulitis spectrum) represent a barely known pathology and often is overlooked or ignored by physicians. Consequently, patients are deprived of appropriate therapy and the scientific community miss an important source of *Fusarium* human pathologic samples for research. Aims of this contribution are: to increase the awareness of physicians to this pathology; to propose a close collaboration between agronomists and physicians and to invite to study the relationship between plant and human diseases due to *Fusarium* occurring within the same geographical areas.

INVESTIGATIONS ON COFFEE WILT DISEASE (CWD) AND THE PATHOGEN, *GIBBERELLA XYLARIOIDES* (*FUSARIUM XYLARIOIDES*). H. Hindorf. INRES-Phytophmedizin, University of Bonn, Nussallee 9, 53115 Bonn, Germany. E-mail: h.hindorf@uni-bonn.de

Coffee wilt or tracheomycosis (CWD) is a vascular disease caused by the fungal pathogen *Gibberella xylarioides* (*Fusarium xylarioides*) and results in a total death of the infected coffee trees. The disease has been a serious problem to coffee production of both Robusta and Arabica coffee in East and Central Africa since the 1980s. The present spread of coffee wilt on Arabica coffee varieties in Ethiopia at an alarming rate strongly justifies the need for joint ventures of national and international cooperation to curb the situation. In this regard the immense contribution of multidisciplinary research works undertaken on wild coffee populations in montane rainforests of Ethiopia and especially the advancement of the German project "Conservation of wild coffee, *Coffea arabica* L., in montane rainforests of Ethiopia" is encouraging. This project is conducted by the Center for Development Research of the University of Bonn and financed by the German Federal Ministry of Education and Research. Emphasis in the second phase of research will be the selection of CWD tolerant/ resistant coffee trees, epidemiological studies on the pathogen race invading Arabica coffee only and biological control studies with *Trichoderma* spp. of the CWD pathogen. Research at time is carried in Ethiopia and preliminary results can be reported during the X EFS.

TOXIN PRODUCTION AND PATHOGENICITY OF *FUSARIUM LANGSETHIAE* FROM WHEAT KERNELS IN ITALY. A. Infantino¹, N. Pucci¹, G. Aureli², M.G. D'Egidio² and A. Santori¹. ¹CRA, Centro di Ricerca per la Patologia Vegetale, Via C.G. Bertero, 22, 00156, Rome, Italy. ²CRA, Centro di Ricerca per la Valorizzazione Qualitativa dei Cereali, Via Cassia 176, 00101, Rome, Italy. E-mail: alessandro.infantino@entecra.it

During a survey of seed health condition of wheat cultivated in the major Italian growing areas, *Fusarium langsethiae* was isolated from kernels of both *Triticum durum* Desf. and *T. aestivum* L. *F. langsethiae* is of particularly interest due to its ability to produce type A trichotecenes mycotoxins (T2 and HT2 toxins). Several *F. langsethiae* isolates were characterized for toxin production by growing them on autoclaved wheat kernels for 15 d at 23°C, followed by 3 d at 4°C and then for 7 d at 32°C. T2 con-

centration was measured with the ELISA Ridascreen T2 kit (Bio-pharm, Italy). All isolates were highly toxigenic, with a toxin production ranging from 8.895 ppb to 34.795 ppb. To evaluate pathogenicity, a conidial suspension (1×10^5 spores ml^{-1}) of the isolate ISPaVe ER-1409 was sprayed on plants of the cv Simeto (10.5.2 Feeke's scale growth stage) in the open field. For symptoms comparison, *F. graminearum* (ITEM 1852) and *F. culmorum* (ITEM 1851) were inoculated at the same concentration of *F. langsethiae*. No symptoms were observed on plants inoculated with *F. langsethiae* and on the controls, while on spikes inoculated with *F. graminearum* and *F. culmorum*, typical fusarium head blight symptoms were present after 15 days. Mycological analyses of kernels obtained from the inoculated spikes confirmed the absence of *F. langsethiae*, while the percentage incidences of *F. graminearum* and *F. culmorum* were 60.0 ± 4.8 and 98.0 ± 0.3 , respectively. T2 evaluation on wheat samples naturally infected with *F. langsethiae* is in progress in order to elucidate the role of this species in toxin contamination.

AGGRESSIVENESS OF TUNISIAN FUSARIUM ISOLATES FROM WHEAT CROWN AND HEAD ON STEM BASES. G.L. Kammoun^{1,2}, S. Gargouri², N. Brahimi¹, I. M'Tat² and M.R. Hajaoui². ¹Laboratoire de Génétique et Biologie Moléculaire, Faculté des Sciences de Tunis, Campus Universitaire, 1060 Tunis, Tunisia. ²Laboratoire de Protection des Végétaux, Institut National de la Recherche Agronomique de Tunisie, rue Hédi Karray, 2049 Tunis, Tunisia. E-mail: lobna_kammoun@yahoo.fr

Crown rot of wheat is a widespread disease of a major constraint under the rain-fed system in Tunisia, whereas *Fusarium* head blight is restricted to the northern regions when high rainfalls occur during spring. The dominant *Fusarium* species isolated from crown tissue were also recovered from wheat spikes. The objective of this study was to evaluate the pathogenicity and aggressiveness of *Fusarium* isolates recovered from spikes on seedling of the spring wheat cultivar 'Karim' in the greenhouse. For this purpose two inoculation techniques were first tested using 13 isolates of *F. culmorum*: spore suspension and mycelium agar plug. Both techniques showed significant differences in aggressiveness among isolates. Overall, the mycelium agar plug inoculation technique resulted in higher severity scores. To screen the pathogenicity and aggressiveness of *F. culmorum*, *Microdochium nivale*, *F. avenaceum* and *F. pseudograminearum* isolated from head, the second technique was adopted. An additional 10 strains of *F. culmorum* isolated from crown tissue were used for comparison. All fungal isolates caused discoloration of lower part of the seedlings with a significant difference in aggressiveness within species. *F. culmorum* and *F. pseudograminearum* caused the greatest discoloration and there was no significant difference among these two species. Besides, this study showed that there was no difference in aggressiveness between *F. culmorum* isolates whether they come from crown tissue or head. These results suggest that infected seeds and plant debris might play an important role in the survival of the pathogens and contribute as source of inoculum for crown rot and head blight.

Work funded in part by the International Foundation for Science (IFS: C/4026-1) and the MERST (Ministère de l'Enseignement Supérieur et de la Recherche de Tunisie, LR00AGR02).

FUSARIUM INFECTION AND MYCOTOXIN CONTENT IN WHEAT AND OAT AFTER SINGLE OR MULTIPLE ARTIFICIAL INFECTION. S.S. Klemsdal¹, H.U. Aamor¹, E. Lysoe¹, J. Razzaghian¹, O. Elen¹, I.S. Hofgaard¹, M. Jestoi² and G.

Brodal¹. ¹Bioforsk-Norwegian Institute for Agricultural and Environmental Research, Plant Health and Plant Protection Division, Aas, Norway. ²Finnish Food Safety Authority, Evira, Chemistry and Toxicology Unit, 31600 Jokioinen Helsinki, Finland. E-mail: sonja.klemsdal@bioforsk.no

Fusarium head blight (FHB) is a widespread and destructive disease of cereals caused by a number of *Fusarium* species. Under field conditions a mixture of *Fusarium* species exists. While FHB in wheat has been well studied, *Fusarium* infection of oats has not yet been characterized. Little is known about how the presence of a mixture of different *Fusarium* species in the same sample affects the mycotoxin production. During flowering plants of wheat and oats grown under greenhouse conditions were spray inoculated with single and multiple *Fusarium* species (*F. graminearum*, *F. culmorum*, *F. avenaceum*, *F. poae* and *F. langsethiae*). Chemical toxin analysis of harvested grain showed that the content of mycotoxins in oat were generally lower than in corresponding wheat samples. Neither T-2 nor HT-2 was detected in wheat or oat. Neither was it possible to detect *F. langsethiae* in the kernels when analysed by real-time TaqMan PCR. All wheat samples inoculated with *F. graminearum* contained relative high levels of deoxynivalenol. Samples infected with *F. culmorum* contained nivalenol in addition to deoxynivalenol. Moniliformin was detected at levels below the quantification limit in one third of the samples. The inoculation experiment was repeated with an adjusted inoculation procedure for *F. langsethiae* and *F. poae*, resulting in good establishment of all *Fusarium* species. The amounts of the different *Fusarium* species and the level of the corresponding mycotoxins were determined. The interactions between the *Fusarium* species regarding establishment on the fungus on the developing kernels and the production of the mycotoxins, will be discussed.

THE EFFECT OF DIFFERENT A_w/TEMPERATURE COMBINATIONS ON THE MYCOTOXIN PRODUCTION OF FUSARIUM STRAINS ISOLATED FROM FINNISH GRAINS. M. Kokkonen¹, L. Ojala¹, P. Parikka² and M. Jestoi¹. ¹Finnish Food Safety Authority, Evira, Mustialankatu 3, 00790 Helsinki, Finland. ²MTT Agrifood Research Finland, FI-31600 Jokioinen, Finland. E-mail: marika.jestoi@evira.fi

Fusarium is the most prevalent and important toxigenic fungal genus infecting cereals in Finland. Several *Fusarium* species are known to produce a variety of mycotoxins, the synthesis of which is greatly affected by the environmental conditions. A study was carried out to assess the effect of environmental factors (a_w/temperature-combinations) on the toxigenic potential of Finnish *Fusarium* species. Seven predominant *Fusarium* species occurring in Finnish grains (*F. avenaceum*, *F. tricinctum*, *F. poae*, *F. culmorum*, *F. graminearum*, *F. sporotrichioides* and *F. langsethiae*) were chosen for the study. Hyphal tip cultures of three strains of each species were inoculated to a mixture of wheat, oats and barley (1:1:1). Each strain was cultivated in triplicate in three different a_w/temperature combinations simulating possible environmental conditions that might prevail in Finnish fields during the growing season. Eighteen *Fusarium*-mycotoxins were extracted from ground grain samples and analysed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). The correlation of different a_w/temperature-combinations and the mycotoxins produced were studied with the aid of statistical analyses. In addition to mycotoxin profiles, the cytotoxicity of the fungal extracts was measured with *in vitro* tests by utilising several cell lines to reveal the possible correlation of cytotoxicity with the mycotoxins determined. The experiment provides information on the effect of environmental conditions on toxin producing properties of Finnish *Fusar-*

ium species. Data can be used to estimate the risk of toxin production in potential Finnish weather conditions.

PATHOGENIC FUNGI ON WHEAT GRAIN IN SERBIA. V. Krnjaja¹, J. Levic² and S. Stankovic.² ¹*Institute for Animal Husbandry, Autoput 16, 11080, Belgrade-Zemun, Republic of Serbia.* ²*Maize Research Institute "Zemun Polje", 11185, Belgrade-Zemun, Republic of Serbia. E-mail: VesnaKrnjaja.IZS@gmail.com*

Wheat is one of the most important crop cultures in Serbia, where it is cultivated on approximately 600,000 ha with average yield of grain of 3,600 kg/ha. Wheat is mainly used for production of bread and in human nutrition. For livestock nutrition wheat grain can be used as concentrated livestock feed, and whole plant can be used as fodder. Considering the economical importance of wheat, primarily in human nutrition, but also in livestock nutrition, microflora of the wheat grain harvested in 2007 in the vicinity of Belgrade in Serbia was investigated. A total of 3,300 wheat grains were investigated for presence of potentially toxigenic fungi species, especially of genus *Fusarium*. After superficial disinfection in sodium hypochlorite, wheat grains were placed on 2% water agar surface, 10 grains per Petri dish, and incubated during 7 days at 26°C. The presence of seven fungal genera was established, namely *Acremonium* (0.09%), *Acremonium* (0.06%), *Alternaria* (96%), *Drechslera* (0.3%), *Fusarium* (3.5%), *Nigrospora* (0.03%) and *Penicillium* (0.03%). Within *Fusarium* eight species were identified, namely *F. graminearum* (63.5%), *F. oxysporum* (1.7%), *F. poae* (0.9%), *F. proliferatum* (5.2%), *F. semitectum* (2.6%), *F. sporotrichioides* (20.9%), *F. subglutinans* (3.5%) and *F. verticillioides* (1.7%). High presence of *F. graminearum* and *F. sporotrichioides* indicated potential danger for the presence of mycotoxins like zearalenone and trichothecene, which cause mycotoxicosis.

A NEW DISEASE OF HOODIA GORDONII IN SOUTH AFRICA. S.C. Lamprecht¹, W.F.O. Marasas², H. Schroers³ and P.W. Crous⁴. ¹*ARC-Plant Protection Research Institute, Private Bag X5017, Stellenbosch 7599, South Africa.* ²*Department of Plant Pathology, University of Stellenbosch, Private Bag X1, Matieland, Stellenbosch 7602, South Africa.* ³*Agricultural Institute of Slovenia, Haquetova 17, Ljubljana, Slovenia.* ⁴*Centraalbureau voor Schimmelfcultures, Fungal Biodiversity Centre, P.O. Box 85167, NL 3508 AD, Utrecht, The Netherlands. E-mail: lamprechts@arc.agric.za*

Hoodia gordonii is an indigenous succulent of the Apocynaceae and is widely distributed in semi-arid areas of southern Africa. The plant, used as an appetite suppressant, was previously subjected to wild harvesting which seriously threatened its survival. Since 2002, *H. gordonii* and other *Hoodia* spp. such as *H. flava*, *H. parviflora*, and *H. curroni* were cited in the Southern African Plant Red Data lists as threatened plant species, and from 2008 no permits will be granted for wild harvesting. In 2005, a new *Fusarium dimerum*-like fungus, which will be described as a new species in due course, was isolated from diseased *H. gordonii* stems collected from a commercial planting in the Clanwilliam district of the Western Cape province. Disease symptoms included black and blistered lesions and dry-rotten stems. Pathogenicity tests were conducted on injured and uninjured 2-mo-old plants in a glasshouse. A spore suspension containing 10⁶ spores/ml and infested toothpicks were used as inoculum. On injured stems, black lesions developed within 3 days post-inoculation, and within 7 days stems were completely rotten following injection of the spore suspension into the stems. It appears that injury is essential

for infection and disease develops rapidly thereafter. The inoculum source under natural conditions is suspected to be soil and injury to plants is most probably caused by sand storms, but this needs confirmation. The distribution and importance of the disease in commercial plantings and wild populations is currently unknown and needs to be investigated due to the popularity of this plant and its commercial value.

PHYLOGENETIC SPECIES, MYCOTOXIN CHEMOTYPES AND GEOGRAPHICAL DISTRIBUTION OF *FUSARIUM ASIATICUM* AND *F. GRAMINEARUM* ON WHEAT SPIKES THROUGHOUT CHINA. H.P. Li¹, J.B. Zhang¹, B. Qu¹, T. Huang¹, F.F. Chen, Y.B. Xu¹, A.B. Wu¹, P. Nicholson² and Y.C. Liao¹. ¹*Molecular Biotechnology Laboratory of Triticeae Crops, Huazhong Agricultural University, Wubao 430070, PR China.* ²*John Innes Centre, Norwich Research Park, Colney, Norwich NR4 7UH, UK. E-mail: yuailiao@mail.hzau.edu.cn*

Fusarium graminearum complex consists of phylogenetically different species causing Fusarium head blight (FHB) on wheat. FHB epidemics occur frequently in the middle and lower regions of the Yangtze River, and in Heilongjiang province in northeastern China. A large number of *F. graminearum* complex isolates were collected from wheat spikes from all the regions in China with a history of FHB epidemics. Strains were subjected to sequence characterized amplified region (SCAR) and amplified fragment length polymorphism (AFLP) analyses. SCAR analyses of 437 strains resolved both species, with 21% being *F. graminearum* (SCAR 1) and 79% being *F. asiaticum* (SCAR 5). AFLP profiles clearly resolved two groups, A and B that were also completely congruent with both species. Mycotoxin chemotyping by serial PCRs revealed that *F. asiaticum* species produced 3-AcDON, 15-AcDON and NIV mycotoxins, with 3-AcDON being the predominant chemotype. However, *F. graminearum* species consist only of 15-AcDON-producers. Identification of a new subpopulation from 15-AcDON-producers revealed a molecular distinction between *F. graminearum* and *F. asiaticum* that produce 15-AcDON. An 11-bp repeat is present in *F. graminearum* within their *Tri7* gene sequences but absent in *F. asiaticum*. The two species appear to have different geographic distributions within China. *F. graminearum* was mainly obtained from wheat growing in the cooler regions where the annual average temperatures were 15°C or lower. In contrast, the vast majority of *F. asiaticum* were collected from wheat growing in the warmer regions where the annual average temperatures were above 15°C.

***FUSARIUM OXYSPORUM*, *FUSARIUM SOLANI*, AND *GIBERELLA FUJIKUROI* SPECIES COMPLEXES CAUSING WILTING AND YELLOWING IN *CICER ARIETINUM*. A. Lopez-Lopez¹, E. Valadez-Moctezuma¹, L.X. Zelaya-Molina¹, N. Marbán-Mendoza² and H.V. Silva-Rojas³.** ¹*Departamento de Fitotecnia, Universidad Autónoma Chapingo, Km. 38.5 Carretera México-Texcoco, Chapingo, Edo. de México, C.P. 56230, México.* ²*Departamento de Parasitología Agrícola, Universidad Autónoma Chapingo, Km. 38.5 Carretera México-Texcoco, Chapingo, Edo. de México, C.P. 56230, México.* ³*Producción de Semillas, Colegio de Postgraduados, Km. 36.5 Carretera México-Texcoco, Montecillo, Edo. de México, C.P. 56230, México. E-mail: evaladez@correo.chapingo.mx*

During 2000-2001 plants of *Cicer arietinum* cv. Desi showing symptoms of wilting or yellowing were recorded from 5 producer localities of Guanajuato, and Michoacan States. Roots and stems with necrosis in the vascular system were selected, and small

pieces were taken from the convergence of healthy and diseased tissue, then the fragments were disinfested, and placed on PDA medium. After three days the mycelia were transferred to other plates, and from them twenty six monoconidial cultures were obtained with standard procedures. DNA was extracted from all the isolates to identify the fungal species involved in these symptoms. Internal Transcribed Spacer region-28S rDNA, and elongation factor 1 α gene were amplified using set primers ITS5-NL4, and EF1-EF2, respectively. Phylogenetic analysis showed that the isolates belong to three different species-complexes: *Fusarium oxysporum* (23 isolates), *F. solani* (1 isolate), and *Gibberella fujikuroi* (2 isolates). The pathogenicity test of each isolate was carried out on 15 days-old seedling of the commercial variety Blanco Sinaloa 92, and the susceptible cultivar JG-62. The evaluation was scored each third day throughout 40 days, post-inoculation. The results obtained shown that 12 isolates of *F. oxysporum* species complex caused total mortality on Blanco Sinaloa, and two of them in JG-62. The other 16 isolates damaged the 50% of the foliage. These results showed the pathogenic capacity of isolates of three *Fusarium* species complexes to cause damage in chickpea. Also, this is the first report of *F. solani* and *G. fujikuroi* species complexes affecting chickpea in Mexico.

FUSARIUM SPECIES ISOLATED FROM SUGARCANE AND THEIR EFFECT ON THE DEVELOPMENT OF THE STALK BORER *ELDANA SACCHARINA* WALKER (LEPIDOPTERA: PYRALIDAE). S.A. McFarlane and R.S. Rutherford. SA Sugarcane Research Institute, P/Bag X02, Mount Edgecombe, 4300, South Africa. E-mail: saron.mcfarlane@sugar.org.za

Certain *Fusarium* species can affect the development and fecundity of *Eldana saccharina* Walker, an important pest of maize and sugarcane in parts of Africa. This was evident in studies conducted in West Africa where stalk damage in maize infected with *Fusarium verticillioides* Sacc. (Nirenberg) was significantly greater due to increased larval numbers and improved larval growth rates. There was also evidence to suggest that moth oviposition was positively affected by epiphytic and endophytic symptomless colonisation by *F. verticillioides*. A similar study was initiated in South Africa using *Fusarium* species isolated from sugarcane stalks with and without *E. saccharina* damage. A total of 223 isolates were obtained, representing 14 cultivars and 11 distinct geographic locations. Of these, 117 were isolated directly from borings, while 65 were isolated from surface sterilised undamaged cane and were considered to be endophytic. The remaining 41 were isolated from cane showing symptoms of pokkah boeng, a disease affecting maize and sugarcane caused by *F. verticillioides* and *F. subglutinans*. Attenuated isolates were incorporated into a diet formulation used to rear *E. saccharina*. Some isolates resulted in improved survival and reduced time taken to pupation: these were considered to be beneficial to the development of *E. saccharina*. Other isolates appeared to be antagonistic, resulting in reduced survival and increased time to pupation. In olfactory choice assays, significant differences in the numbers of larvae attracted to maize kernels inoculated with different *Fusarium* isolates were noted. Molecular methods (ISSR and direct sequencing) were used to group and identify the most beneficial and antagonistic *Fusarium* isolates.

RELATIONSHIP OF *STRIACOSTA ALBICOSTA* INFESTATION IN MAIZE TO FUMONISINS IN GRAIN AND CO-PRODUCTS OF ETHANOL PRODUCTION. G. Munkvold¹, R. Hellmich² and A. Pometto³. ¹Iowa State University Department

of Plant Pathology, 160 Seed Science Center, Ames, IA 50011, USA. ²USDA-ARS Corn Insects and Crop Genetics Research Unit, Iowa State University, 106 Genetics Lab, Ames, IA 50011 USA. ³Iowa State University Department of Food Science and Human Nutrition, 2312 Food Science Building, Ames, IA 50011 USA. E-mail: munkvold@iastate.edu

Predation of maize ears by lepidopteran insects can lead to increased infection by mycotoxigenic fungi and higher levels of mycotoxins in maize grain. Maize plants attacked by *Ostrinia nubilalis* (European corn borer, ECB) typically have elevated levels of fumonisins unless they are protected from injury by transgenic insect resistance genes. *Striacosta albicosta* (Western bean cutworm, WBCW) is a pest of maize ears that has rapidly expanded its range into the major maize-producing states in the U.S. Its potential effects on *Fusarium* infection and fumonisins may differ from the effects of ECB infestation. Our objectives are: to measure the impact of WBCW infestation on the quality of maize grain for ethanol production, including *Fusarium* ear rot symptoms, fumonisins in grain and distiller's grains, and ethanol production efficiency; and to assess whether transgenic insect resistance can prevent losses in quality due to feeding by this insect. Six commercial maize hybrids were planted in a field experiment in 2007 and infested with either ECB or WBCW. In hybrids lacking transgenic resistance to WBCW, *Fusarium* ear rot symptoms and fumonisin levels were elevated by as much as 9.5X in the treatments infested with this insect compared to the noninfested treatment. Hybrids with transgenic resistance to WBCW (Bt event TC1507) did not experience significant increases in fumonisins as a result of WBCW infestation. These results are discussed along with the implications of insect resistance, *Fusarium* infection, and fumonisins for maize-based ethanol production and the accumulation of fumonisins in distillers' grains used in livestock feed.

FUSARIUM (MONILIFORME) VERTICILLOIDES AND FUSARIUM SEMITECTUM AS SOME OF THE CAUSES OF RICE GRAIN SPOTTING IN CAMEROON AND NIGERIA. G.N. Ngala^{1,2} and M.O. Adeniji¹. ¹Department of Crop Protection and Environmental Biology, Faculty of Agriculture and Forestry, University of Ibadan, Ibadan, Nigeria. ²Department of Biology, Bamenda University of Science and Technology, P.O. Box 5135 Bamenda Nkwen, Mezam Division, NW Province, Cameroon. E-mail: gngngala@yahoo.com

Rice grain spotting is a serious disease in tropical Africa. Different fungi and other factors have been implicated. However, their detection has always been difficult because of variation in prevalence with region, season, and methodology. Detection methods have only been based on plating whole grains either on the blotter or agar, which gave inconsistent and conflicting results. The cause of rice grain spotting in Cameroon and Nigeria was studied using the single spot isolation technique. Out of 21 survey isolations from the wet and dry season crops *Fusarium (moniliforme) verticilloides* (17.25%) and *Fusarium semitectum* (14.25%) were the next fungi isolated most frequently. *Sarocladium attenuatum* (46.76%) showed the highest mean isolation frequency. Pathogenicity studies showed that they were capable of causing the disease without insects. Disease severity increased with increasing inoculum. This study showed that these *Fusarium* species are among the fungi causing rice grain spotting in Cameroon and Nigeria. Four isolates of each *Fusarium* species from different locations did not differ significantly in their virulence to three rice cultivars under upland conditions. Inoculations of cultivar BG 6850 at panicle initiation and booting resulted in severe disease. These indicated their potential to reduce

yields. Field and laboratory pathogenicity tests with the two species showed that they were pathogenic, that more than one fungus is associated with this disease, their prevalence varying with location and season, and that these *Fusarium* species reproduced similar symptoms on the same rice hosts. Generally dwarf cultivars were more susceptible than the taller ones.

FUSARIUM WILT OF CHICKPEA AND PIGEONPEA AND THEIR MANAGEMENT IN SEMI-ARID TROPICS. S. Pande¹, M. Sharma¹, P.M. Gaur¹, K.B. Saxena¹, C.L.L. Gowda¹, O. Gupta², L. Kaur³, M.S. Sangwan⁴, R.N. Chaudhary⁵, B.M. Jamadagni⁶, D.R. Saxena⁷ and H.K. Ramappa⁸. ¹International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh. ²Department of Plant Breeding & Genetics, JNKVV, Jabalpur. ³Department of Plant Breeding, Genetics and Biotechnology, PAU, Ludhiana, Punjab. ⁴Department of Plant Pathology, CCSHAU, Hisar. ⁵Indian Institute of Pulses Research, Kanpur. ⁶MPKV, Rahuri, Maharashtra. ⁷RAK College of Agriculture, Sehore, Madhya Pradesh. ⁸UAS, GKVK, Bangalore, India. E-mail: s.pande@cgiar.org

Fusarium wilt of chickpea (*Cicer arietinum* L.) caused by *Fusarium oxysporum* f. sp. *ciceris* (FOC) and pigeonpea (*Cajanus cajan* (L.) Millsp. caused by *F. udum* (FU) are the major production constraints to these legumes worldwide, specifically in the Indian subcontinent and Eastern Africa (chickpea and pigeonpea) and the Mediterranean region (chickpea). In India alone these wilts cause up to 100% crop losses on susceptible cultivars under favorable environmental conditions. Host plant resistance offers the most sustainable and effective wilt management option either alone or as a major component of integrated disease management. Effective greenhouse and field screening techniques have been developed at the International Crops Research Institute for the Semi-Arid tropics (ICRISAT), Patancheru, India to identify resistance in the germplasm and to incorporate resistance in breeding lines of chickpea and pigeonpea. More than 17,000 lines of chickpea and 12,000 lines of pigeonpea have been screened using these techniques at ICRISAT. Significant positive correlation was found between seedling screening in greenhouse and adult plant screening in the wilt-sick fields. Chickpea and pigeonpea lines found resistant to *Fusarium* wilt at ICRISAT were further evaluated through International Chickpea Wilt and Root Rot Nursery (ICWRRN) and International Pigeonpea Wilt Nursery (IPWN) to identify stable and broad based resistance at hot spot locations in Asia and Africa. Several breeding lines have shown stable and durable resistance to *Fusarium* wilt of chickpea and pigeonpea, and many improved wilt resistance varieties have been adopted by farmers. The differential wilt disease reaction in few lines in multi-location testing indicated variability in FOC and FU populations.

FUSARIUM LANGSETHIAE INFECTION AND MYCOTOXIN CONTENTS OF OATS AND BARLEY. P. Parikka¹, V. Hietaniemi², S. Rämö² and H. Jalli¹. ¹MTT Agrifood Research Finland, Plant Production Research, Finland. ²MTT Agrifood Research Finland, Laboratories, 31600 Jokioinen, Finland. E-mail: patvi.parikka@mtt.fi

In the field trial of 2004-2006, the first *Fusarium* species, detected at panicle emergence of oats, was *F. langsethiae*. It was found also on barley at ear emergence, but the amount of infected kernels was not so high as on oats. *F. langsethiae* was the most common *Fusarium* species on oats during the early development of kernels. The other species detected at early stages in flowers

and kernels of oats was *F. poae*. Later in the season, other *Fusarium* species infected kernels and the prevalence of *F. langsethiae* in harvested grain was low. In 2006, however, infection by species like *F. avenaceum* and *F. culmorum* was inhibited in dry conditions and *F. langsethiae* was fairly abundant in harvested, dried grain. It was present both in oats and barley grown in traditionally tilled and direct drilled areas. As a whole, more infection was seen on oats than on barley and more in late cultivars than in early ones. The prevalence of *F. langsethiae* varied: in 2004 it was slightly more prevalent in tilled than in direct drilled areas but in 2006 in dry conditions direct drilling seemed to produce more infected kernels and grain than tillage. *F. langsethiae* seems to be a more important producer of T2 and HT-2 toxins than *F. sporotrichioides* in Finland. The analysed contents of these mycotoxins were higher on oats (max 950 µg/kg) than on barley (max. 710 µg/kg). In 2006, the T2+HT-2 contents of oats were higher in direct drilled than in tilled plots.

FUSARIUM SPECIES ASSOCIATED WITH VANILLA STEM ROT IN INDONESIA. A. Pinaria¹, L.W. Burgess¹ and E.C.Y. Liew². ¹Faculty of Agriculture, Food and Natural Resources, The University of Sydney, NSW 2006, Australia. ²Botanic Gardens Trust, Mrs Macquaries Road, Sydney, NSW 2000, Australia; E-mail: apin3761@mail.usyd.edu.au

Indonesia is one of the world's leading producers of vanilla, an important crop offering high economic returns to small-holder farmers. A major constraint in vanilla production in Indonesia is stem rot disease, which has caused significant economic losses over the last decade. Previous reports of vanilla stem rots in the Asia-pacific region include those caused by *Fusarium*, *Colletotrichum*, and *Phytophthora* species. In this paper, we report *Fusarium* species associated with the disease. Seven major vanilla-producing provinces were surveyed for disease incidence. Isolates were obtained from diseased stem tissues using selective media. Pure cultures were subcultured onto CLA and PDA for species identification. A total of 542 *Fusarium* isolates were recovered, comprising 7 species, namely *F. decemcellulare*, *F. oxysporum*, *F. proliferatum*, *F. pseudograminearum*, *F. semitectum*, *F. solani*, *F. subglutinans*, and 14 isolates of undescribed species. *F. oxysporum* was most commonly isolated from all the areas surveyed, followed by *F. solani* and *F. semitectum*. Of the species tested in pathogenicity studies, only *F. oxysporum* was shown to be pathogenic to vanilla. Further studies to investigate genetic diversity of the pathogen and host resistance are underway.

ASSESSMENT OF ENDOPHYTIC COLONIZATION OF SORGHUM BICOLOR SEEDLINGS BY GIBBERELLA ZEAЕ. S.A.J. Quazi¹, L.W. Burgess² and J. Smith-White². ¹Plant Pathology Division, Bangladesh Rice Research Institute, Gazipur-1701, Bangladesh. ²Faculty of Agriculture, Food and Natural Resources, The University of Sydney, NSW 2006, Australia. E-mail: q.shireen@bdonline.com

The susceptibility of grain sorghum (*Sorghum bicolor*) to colonization by *Gibberella zeae* was assessed by isolation studies involving plants grown in the glasshouse. The glasshouse studies on infection of sorghum seedlings by *G. zeae* indicated that this pathogen can infect sorghum at early growth stages and gradually colonize adjacent tissues as an endophyte. The results also showed that roots as well as stalk tissues are susceptible to infection. The results suggested that the fungus could infect and colonize the proximal parts of roots more aggressively than the leaf sheaths and

stem tissues. Further studies in the glasshouse and field are warranted to clarify the mode of infection and colonization.

FUSARIUM VERTICILLIOIDES ATTACKING CARNATION IN COLOMBIA. C.Y. Quinche, J.C. Soto, F.E. Pabón and J.J. Filgueira. *Department of Science, Biotechnology Laboratory, Militar University Nueva Granada, Bogotá, Colombia. E-mail: jfilgdu@umng.edu.co*

Isolation of *Fusarium* spp. was carried out from symptomatic plants provided by different carnation farms located in the Bogotá plateau. Colony characteristics, spore type and molecular identification using genus universal primers were carried out. Three isolates were characterized as *Fusarium oxysporum*, two as *F. roseum* and one was identified as *F. verticillioides*. The first two species have been reported as pathogens of carnation, while *F. verticillioides* has never been reported to attack carnation plants. The development of the disease was studied under greenhouse conditions, differentiating the symptomatology caused by *F. verticillioides* from that determined by *F. oxysporum* and *F. roseum*. Pathogenicity assays were performed in greenhouse using adult plants and germination trays. Moreover, undifferentiated carnation calli and microplants were used to evaluate the *in vitro* response to pathogen.

AIR-AND SPLASH-DISPERSAL OF FUSARIUM VERTICILLIOIDES IN MAIZE CROPS. V. Rossi, A. Scandolara and P. Battilani. *Istituto di Entomologia e Patologia Vegetale, Università Cattolica del Sacro Cuore, Via E. Parmense 84, I-29100 Piacenza, Italy. E-mail: paola.battilani@unicatt.it*

Silks are an important infection pathway of maize kernels by *Fusarium verticillioides*. Inoculum for silk infection is represented by the conidia produced on the infected maize stalk residues onto the ground. To study the patterns of inoculum dispersal from stalk residues to silks, stalk pieces were inoculated with *F. verticillioides*, managed to favour sporulation, and placed above the soil in maize crops grown in North Italy at silking, in 2003 to 2005. Propagula were trapped daily at silk height using Petri dishes with a selective medium and microscope slides covered with carboxy-methyl cellulose and counted as CFU/cm² of the trapping surface, for a total of 87 samples. Propagules were present in 52% of the samples, with an average of about one CFU/cm² and a peak of 16 CFU/cm². Twenty-one percent of the trappings occurred in rainy days and 75% of them in no-rainy days with <60% relative humidity. To better understanding the splash-dispersal behaviour of conidia, splashing droplets were caught at different heights and distances from sporulating stalk residues. Ninety-three percent of the droplets was found within 40 cm in horizontal and 20 cm in vertical from the source, with a maximum distance of 100 cm and 60 cm, respectively. Droplet number and size, as well as the number of dispersed conidia, diminished with distance. It was concluded that the inoculum produced on infected stalks on the ground reaches silks through air currents and, during rainy days, through following rain-splashes that use leaves as temporary deposition floors.

AN ITALIAN SURVEY ON SUBCUTANEOUS AND DEEP INFECTIONS BY FUSARIUM, 2006-2007. S. Sanna, C. Farina, S. Andreoni, M. Conte, P. Fazii, G. Lombardi and E. Manso. *Medical Mycology Committee (CoSM), Associazione Microbiologi*

Clinici Italiani, Via Carlo Farini 81, 201591 Milano, Italy. E-mail: silvana@uniss.it

Invasive fungal infections are an important cause of morbidity and mortality in immunocompromised patients. Improvements in the management of critical care and neoplastic diseases, and development of newer antimicrobial agents have contributed to the emergence of new fungi and the resurgence of older. Between them, *Fusarium* species are uncommon organisms with increasing reports in neutropenic patients and in patients undergoing bone marrow and solid organ transplantation. The Medical Mycology Division (CoSM) of the Associazione Microbiologi Clinici Italiani (AMCLI) proposed the institution of: (i) a national register (2006-2007) of all cases of infection by uncommon moulds, including *Fusarium*, implicated as aetiological agents in subcutaneous and deep mycoses, and (ii) a fungal collection, to perform *in vitro* epidemiological typing and chemosensitivity studies. The strains isolated at each Laboratory have been identified by means of standard procedures and confirmed by sequencing a fragment encoding the ribosomal large subunit RNA and by comparing in the GenBank database using the Blast alignment program. Chemosensitivity testing (Amphotericin B, Flucytosine, Fluconazole, Itraconazole and Voriconazole) have been done according to the NCCLS M38-A Document. In 2006-2007 twelve Italian Centers sent 68 strains. Between them, *Fusarium* species represent the second (15/68) filamentous fungus after *Aspergillus* (22%): *F. verticillioides* was the most frequent species isolated (11/15) followed by *F. solani* (3/15) and *F. oxysporum* (1/15). A higher rate of positive blood cultures and dissemination is actually associated with *Fusarium*, and often skin, eyes and CSF are frequently the primary source of infection. Outcome of the infection is associated with neutrophil recovery. The new antifungals triazoles including voriconazole have shown activity against *Fusarium*.

ROLE OF INOCULUM DOSE AND SILK GROWTH STAGE ON INFECTION OF MAIZE EARS BY FUSARIUM VERTICILLIOIDES. A. Scandolara¹, V. Rossi¹, A. Pietri² and P. Battilani¹. ¹*Istituto di Entomologia e Patologia Vegetale,* ²*Istituto di Scienze degli Alimenti e della Nutrizione, Università Cattolica del Sacro Cuore, Via E. Parmense 84, I-29100 Piacenza, Italy. E-mail: paola.battilani@unicatt.it*

Fusarium verticillioides can infect maize during flowering through silks, but information on the role of inoculum dose and ear susceptibility in different stages after silk emission is not available. Trials were managed using a medium season maize hybrid grown in Northern Italy to fill these gaps of knowledge. Role of inoculum concentration: in 2004, 20 ears were collected 17 days after pollination (DAP). They were silk-inoculated *in vitro* by spraying 2 ml of a conidial suspension and incubated at 25°C for 14 days; four different inoculum concentrations were considered (10 to 10⁷ conidia/ml). Infection incidence was always around 100% of kernels with no significant effect of the inoculum concentration. Role of growth stage: in 2005, 4 ears were sampled at 7-day intervals between 3 and 52 DAP, silk-inoculated *in vitro* (10⁶ conidia/ml) and incubated as previously described. Infection incidence was higher at 10 and 17 DAP, but about 70% of kernels were infected also in the other growth stages. Role of growth stage on fumonisin contamination (in field trials): in 2004 and 2006, silks were inoculated between 3 and 52 DAP and managed to prevent ears from any natural infection. At ripening, inoculated ears were hand harvested and shelled, dried, milled and fumonisins (FBs) were quantified. All the artificial inoculations managed in field lead to FBs production with no significant differences between the inoculation stages.

SPATIAL DISTRIBUTION OF *FUSARIUM* SPECIES AND ASSOCIATED MYCOTOXINS IN WHEAT FIELDS. N. Schlang¹, U. Steiner¹, H.W. Dehne¹, C. Waalwijk², P.M. de Vries², D. Herebian³, S. Zühlke³, M. Spittler³ and E.C. Oerke¹. ¹Institute of Crop Science and Resource Conservation, University of Bonn, Nussallee 9, 53115 Bonn, Germany. ²Plant Research International, Droevendaalsesteeg 1, 6708 PB Wageningen, The Netherlands. ³Institute of Environmental Research, University of Dortmund, Otto-Hahn-Strasse 6, 44221 Dortmund, Germany. E-mail: N.schlang@uni-bonn.de

Over eight species of the genus *Fusarium* are involved in the Fusarium head blight complex in Western Europe and most of these species are able to produce one or more mycotoxins. The production of mycotoxins often differs between isolates of the same species. Little is known about the spatial distribution of the species or chemotypes in the field and therewith the spatial distribution of the related mycotoxins. The aim of this study was to examine the spatial distribution of the major Fusarium Head Blight pathogens and their associated mycotoxins. Eighty-four samples of wheat were taken from two fields in Germany from a 20 to 20 m grid. One of the fields were on virgin soil the other had a wheat cultivation history. Kernels were examined for infection with *Fusarium* spp. using microbiological and Real-Time-PCR methods and were analysed for mycotoxin contamination with a LC-MS/MS method. Different factors which could be related to infection or mycotoxin contamination (soil compaction, soil organic matter, apparent electric conductivity, etc.) were measured and mapped together with the results using geographic information systems. *Fusarium poae* and *F. graminearum* were the most frequent species. The total level of *Fusarium* infection at the sampling points ranged from 32 to 84%. Species were distributed heterogeneously in the field and were aggregated in some cases. The associated mycotoxins were distributed either homogeneously or aggregated. We did not observe a positive correlation between any of the soil factors and level of *Fusarium* infection.

SOME CHARACTERISTICS OF *FUSARIUM* SPECIES OCCURRING IN SUGAR BEET IN THE NETHERLANDS. J.H.M. Schneider and P.M.S. Musters van Oorschot. IRS, Van Konijnenburgweg 24, 4611HL, Bergen op Zoom, The Netherlands. E-mail: schneider@irs.nl

Fusarium yellow of sugar beet is caused by *Fusarium oxysporum* f. sp. *betae*. Symptoms include vascular discoloration, root rot, chlorosis and necrosis of sugar beet leaves and a reduced sugar content. From sugar beet plants showing fusarium yellows symptoms in the Netherlands different *Fusarium* species were isolated between 2002 and 2007. These isolates were first grouped according to their colony morphology and secondly using enterobacterial repetitive intergenic consensus (ERIC) PCR and repetitive extragenic palindromic (REP) DNA fingerprints in comparison with described isolates. Presumable *F. culmorum* and *F. graminearum* isolates were tested with specific primers and from other isolates the sequence of the α -elongation factor and the β -tubuline gen was determined and blasted in Genbank and in FUSARIUM-SEQ v.1.0 database. In total 14 *Fusarium* species were identified, amongst which *F. oxysporum*, *F. solani*, *F. culmorum*, *F. equiseti*, *F. redolens*, *F. venenatum*, *F. acuminatum* and *F. graminearum*. Only part of the isolates tested were pathogenic to sugar beet seedlings. Screening the isolates for mycotoxin genes indicated the potential for mycotoxin production. *F. venenatum* isolates were found to be potential type A trichothecene producers. All *F. graminearum* isolates were characterised as 15-AcDON chemotypes. Most of the *F. culmorum* isolates were 3-AcDON

chemotypes and a few NIV chemotypes, but there seems to be a shift towards NIV chemotypes in recent years. Characterisation of the *Fusarium* species and their pathogenic potential in sugar beet is essential to avoid food safety problems and for breeding for resistance, which seems the only solution for this problem.

TOXIGENICITY AND PATHOGENICITY OF *FUSARIUM POAE* AND *FUSARIUM AVENACEUM* STRAINS IN WHEAT - RESULTS OF FIELD, CLIMATE CHAMBER, AND LABORATORY STUDIES. S. Vogelgsang¹, M. Sulyok², A. Hecker¹, E. Jenny¹, I. Bänziger¹, R. Schuhmacher² and H.R. Forrer¹. ¹Research Station Agroscope Reckenholz-Tänikon ART, Reckenholzstrasse 191, 8046 Zurich, Switzerland. ²Center for Analytical Chemistry, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Applied Life Sciences, Konrad Lorenz Strasse 20, 3430 Tulln, Austria. E-mail: susanne.vogelgsang@art.admin.ch

The cereal disease Fusarium head blight (FHB) is caused by a complex of *Fusarium* species. Compared with mycotoxins produced by *F. graminearum* (e.g. deoxynivalenol), some toxins of *F. poae* (e.g. nivalenol, diacetoxyscirpenol, T-2) and of *F. avenaceum* (e.g. moniliformin) display a far greater toxicity. This could have significant implications on human and animal health. Moreover, since plants in the field and harvested grains infected by *F. poae* or *F. avenaceum* lack symptoms as distinct as those observed from *F. graminearum*, contaminated cereal lots may be overlooked. In a 3-year field experiment, we observed highly significant differences in the susceptibility of 14 winter wheat varieties to *F. poae* and *F. avenaceum* with incidence on grains ranging from 6 to 49% and from 69 to 92%, respectively. Infections were achieved with a mixture of three strains from each of the two species. For *F. poae*, a strong correlation between fungal incidence and nivalenol content ($r^2 = 0.89$) was observed. In a climate chamber experiment on the spring wheat cultivar Apogee, we found substantial differences in aggressiveness between individual strains. In samples from field and climate chamber experiments, 60 to 4,860 $\mu\text{g kg}^{-1}$ nivalenol and 2,400 to 17,000 $\mu\text{g kg}^{-1}$ moniliformin were detected in grains infected with *F. poae* and *F. avenaceum*, respectively. In an *in vitro* study where the same strains were incubated on different cereal substrates, we observed strong substrate effects as well as strain-specific substrate effects on the quantitative and qualitative composition of toxins.

GEOGRAPHIC VARIATION IN THE SOIL PREVALENCE OF *FUSARIUM OXYSPORUM* f. sp. *VASINFECTUM* AMONG THREE MAJOR COTTON GROWING DISTRICTS IN AUSTRALIA. B. Wang¹, C.L. Brubaker^{1,2}, P.H. Thrall¹ and J.J. Burdon¹. ¹CSIRO Plant Industry, Black Mountain, GPO Box 1600, Canberra, ACT 2601, Australia. ²Bayer BioScience N.V. Technologiepark 38, 9052 Gent, Belgium. E-mail: bo.wang@csiro.au

Two genetically distinct strains of *Fusarium oxysporum* f. sp. *vasinfectum* (*Fov*) are responsible for *Fusarium* wilt of cotton in Australia. While VCG 01112 is restricted to a small area where it was initially found, VCG 01111 occurs in all *Fov* infested cotton growing districts, causing significant yield losses. First found in 1993 in the Darling Downs region, the dominant VCG 01111 rapidly spread to the Boggabilla region and subsequently to the Moree region. Recent surveys of VCG 01111 infested fields showing similar disease incidence across these three cotton growing districts found a clear decline in the soil prevalence of *Fov* from the Darling Downs (centre of origin) to Boggabilla and Moree. The highest density of soil *Fov* was 1100 colony produc-

ing units (CPU)/g in the Darling Downs, but it was 700 CPU/g in Boggabilla and only 400 CPU/g in Moree. Consistently, the mean frequency of *Fov* in soil *F. oxysporum* populations was 23% in the Darling Downs and 12% in Boggabilla, but only 2% in Moree. Further studies are being conducted to investigate the question of why *Fov* causes comparable level of disease at lower soil prevalence in Moree soils relative to the Darling Downs soils. It is hypothesized that the saprophytic ability of *Fov* is influenced by soil factors (biotic or abiotic), and trade-off may exist between saprophytic ability and aggressiveness of *Fov*. For example, to maximise fitness, *Fov* may evolve increased aggressiveness in alien, non-preferred soils to cope with lower soil prevalence due to reduced saprophytic ability.

CHARACTERISATION OF THE SNOW PEA WILT PATHOGEN IN AUSTRALIA. A.L. Yousiph^{1,3}, A. Watson², L.W. Burgess³ and E.C.Y. Liew¹. ¹Royal Botanic Gardens Sydney, Botanic Gardens Trust, Mrs. Macquaries Road, Sydney, NSW 2000, Australia. ²Department of Primary Industries, Yanco Agricultural Institute, Trunk Road, Yanco, NSW 2703, Australia. ³Faculty of Agriculture, Food and Natural Resources, The University of Sydney, Sydney, NSW 2006, Australia. E-mail: Ameera.yousiph@rbgsyd.nsw.gov.au

Fusarium wilt, caused by *Fusarium oxysporum* f. sp. *psii*, is the most devastating disease of snow peas in Australia. Severe outbreaks of the disease were observed in 2005 and 2006 throughout the main growing regions in Queensland, New South Wales and Victoria. In Victoria, pea crops were also similarly affected. Current disease management strategies include crop rotation, fungicide application and seed dressing. There is, however, a need for the establishment of more sustainable control measures, which require information on the pathogen population. A total of 110 isolates were collected from the main growing regions and analysed on the basis of their haplotypes, VCG and pathogenic races. RAMS and rep-PCR were chosen for the haplotype analysis. No genetic differentiation was observed between isolates collected from pea and snow pea plants. It was also found that the population consisted of two large haplotype groups with 62% of isolates in one group and 30% of isolates in the other. The remaining isolates were found to be unique haplotypes. There was no correlation between haplotype group and geographic origin of the isolates. These findings indicate that there is a moderate level of genetic diversity within this pathogen population in Australia, which needs to be taken into consideration in the development of

management strategies. As there is a lack of clonality and correlation with geographic location, control measures cannot be targeted to specific haplotypes or regions.

DIVERSITY OF *FUSARIUM OXYSPORUM* SPECIES COMPLEX ASSOCIATED TO CHICKPEA IN THE EAST AND NORTHEAST AREAS OF MEXICO. L.X. Zelaya-Molina¹, E. Valadez-Moctezuma¹, A. Lopez-Lopez¹, N. Marbán-Mendoza², H.V. Silva-Rojas³. ¹Departamento de Fitotecnia, Universidad Autónoma Chapingo, Km. 38.5 Carretera México-Texcoco, Chapingo, Edo. de México, C.P. 56230, México. ²Departamento de Parasitología Agrícola, Universidad Autónoma Chapingo, Km. 38.5 Carretera México-Texcoco, Chapingo, Edo. de México, C.P. 56230. ³Producción de Semillas, Colegio de Postgraduados, Km. 36.5 Carretera México-Texcoco, Montecillo, Edo. de México, C.P. 56230, México. E-mail: evaladez@correo.chapingo.mx

Chickpea (*Cicer arietinum* L.) is an important legume crop in Mexico, and 90% of its production is exported to Spain and USA. One of the most important diseases affecting this crop is *Fusarium* wilt, causing losses of 10-15% in the national production. *F. oxysporum* f. sp. *ciceris* has been reported as the main agent of this disease. Nevertheless, new researches focused on genetic diversity have shown the existence of polyphyletic evolutionary origins inside different *forma specialis* of *F. oxysporum*, and this complex appears to consist of a large number of predominantly clonal lineages distributed among several clades, that in a close future could be denominated as phylogenetic species. Inside these new concepts, the aim of this research was to know the diversity of *F. oxysporum* species complex (FOC) associated to this disease. Plants showing symptoms of wilt or yellowing were recorded from the most important producing areas of chickpea in Mexico, Bajío Region (east area) and Sinaloa State (northeast area). Fifty isolates were obtained from plants showing these symptoms, and DNA was extracted from them following Bainbridge's method. Internal Transcribed Spacer region-28S rDNA, and Elongation Factor 1 α gene were amplified, and sequenced. The sequences were analyzed, and a phylogenetic tree was constructed using Maximum Parsimony. Phylogenetic analysis showed that the isolates belong to FOC, and correspond to at least three different phylogenetic clades, with different evolutionary origins, showing the diversity of the Mexican isolates of FOC associated to chickpea, as it has been reported in other crops.

