Viral Diseases

V 1

***ALFALFA MOSAIC VIRUS* (AMV) ON ALFALFA (*MEDICAGO SATIVA* L.) IN SAUDI ARABIA**. Ibrahim M. Al-Shahwan, Plant Protection Department, College of Agriculture, King Saud University, P.O. Box 2460, Riyadh 11451, Kingdom of Saudi Arabia, E-mail: ishahwan@ksu.edu.sa

Frequent field visits to alfalfa fields at different locations in four regions in Saudi Arabia were carried out to identify *Alfalfa mosaic virus* (AMV) during the period from 1987 to 1999. The observed field symptoms were variable and included mosaic, mottling, stunting, distortion, calico and other symptoms. Mechanical inoculation with one isolate of this virus resulted in local lesions on *Chenopodium amaranticolor* Coste& Ryen. and *Gomphrena globosa* L., and systemic mosaic on *Capsicum annuum* L., *M. sativa* L., *Nicotiana glutinosa* L., *N. tabaccum* L., and *Solanum nigrum*. No symptoms were observed on *Cucumis melo* L. and *C. sativus* L. and *Lycopersicon esculentum* Mill. plants. The thermal inactivation point (TIP) for this isolate was between 60-70 C and the dilution end point (DEP) was between $1x10^{-3}$ and $1x10^{-4}$ and the longevity in vitro was four days. The enzyme-linked immunosorbent assay (ELISA) was used to detect alfalfa mosaic virus in alfalfa leaf tissue samples collected from different fields at 23 widely seperated locations (average of 3 samples/ field and 1-3 fields/ location) or in samples brought to the laboratory by farmers. The results indicated that this virus was found at all locations and in all the tested samples (184) except two, one from Al-Deriyah and the other from Al-Waseel locations. This is the first confirmed report regarding the presence of AMV in three regions (Asser, Gassim and Najran) and of its wide occurrence in 16 locations in the Riyadh region, the most important area for alfalfa production in Saudi Arabia.

V 2

THE MOST IMPORTANT VIRUSES AFFECTING CUCURBITES IN SYRIA. A.A. Haj Kassem[1], Khalil Abdul Halim[2] and Om Eltuka Ghufran Rifai[3]. (1) Faculty of Agriculture, Aleppo University, P.O. Box 7548, Aleppo, Syria; (2) Directorate of Plant Protection, Ministry of Agriculture and Agrarian Reform, Damascus, Syria; (3) Seed Health Laboratory, Agriculture Directorate, Aleppo, Syria.

A field survey was conducted to determine the incidence of virus diseases affecting cucurbites in Syria, during 1999/2000 and 2000/2001 growing seasons. A total of 1689 plant samples with symptoms suggestive of virus infection were collected from 162 fields. Serological results showed that eight viruses naturally infecting cucurbites in Syria. *Zucchini yellow mosaic virus* (ZYMV) was the most commonly encountered virus in cucurbites fields, followed by *Cucumber mosaic virus* (CMV), *Watermelon mosaic 2 virus* (WMV-2), *Zucchini yellow fleck virus*

(ZYMV), one virus of the family Luteoviridae, *Squash mosaic virus* (SqMV), *Cucumber green mottle mosaic virus* (CGMMV) and *Melon necrotic spot virus* (MNSV). The rate of infection in samples tested for the presence of one, two and three or more viruses were 16.8, 30.8 and 34.5%, respectively. The results showed that virus incidence was higher in the first season 1999/2000 than in the second season 2000/2001. The natural infection of cucurbit plants with some viruses was recorded for the first time in Syria.

V 3

MOLECULAR ANALYSIS OF THE REACTION OF SUGAR BEET PLANTS TO THE RESISTANCE INDUCTOR (BION®) AS WELL AS ON THE INFESTATION BY *POLYMYXA BETAE* AND RIZOMANIA. A.M. Mouhanna[1], G. Langen[2], K.H. Kogel[2] and E. Schloesser[2]. (1) General Commission for Scientific Agricultural Research, P.O. Box 113, Douma, Damascus, Syria, E-mail: AhmadMouhanna@gmx.net; (2) Institut for Phytopathology and Applied Zoology, Justus-Liebig-University, Heinrich-Buff-Ring 26-32, D-35392 Giessen, Germany

Rhizomania is a soil-borne disease of sugar beet roots, which is caused by two viruses, *Beet necrotic yellow vein virus* (BNYVV) and *Beet soil-borne virus* (BSBV) and transmitted by the vector *Polymyxa betae*. A heavy infestation leads to yield losses up to 70% and a substantial reduction of sugar content. Systemic Acquired Resistance (SAR, synonym: Induced Resistance) is a new principle to control plant pathogens. The aim of this approach is not to directly control phytopathogenic organisms by toxic agents but the activation of the naturally existing plant resistance potential against a broad spectrum of plant pathogens by application of so-called plant resistance inducers. This resistance potential could be activated in sugar beets with the help of BION® (ASM: Acibenzolar-S-methyl) as an inducer of SAR. Treatment of plants with the resistance activator or an infection with microorganisms induces a substantial *de novo* synthesis of PR-proteins (pathogenesis-related proteins), especially β-1,3-glucanases and chitinases which are not detected in non-infected or non-treated control plants. In several trials the activator BION® reduced the level of BNYVV and BSBV in rhizomania-tolerant and -susceptible sugar beet cultivars. Therefore, different hypothesis on whether BION® causes accumulation of PR-proteins as a proof of the activation of defense against pathogens in intercellular and extracellular regions in leaves and roots were examined. In addition, whether a transcript accumulation of chitinase III occurred in leaves and roots of sugar beet plants after an infection with rhizomania or virus-free *Polymyxa betae* was also examined.

V 4

OCCURRENCE AND MANAGEMENT OF BEAN LEAFROLL VIRUS IN FOOD LEGUME CROPS IN WEST ASIA AND NORTH AFRICA REGION.

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Bean leafroll virus (BLRV, family Luteoviridae) is an economically important disease affecting several legume crops in many countries of West Asia and North Africa (WANA). The main symptoms produced by the virus are leaf yellowing, plant stunting, reddening, thickening of the leaves and suppression of flowering and pod set. BLRV is persistently transmitted by aphid species. Surveys made in nine countries in WANA (Ethiopia, Iran, Iraq, Jordan, Pakistan, Tunisia, Turkey, Syria and Yemen) during the period of 1996-2001 indicated that BLRV was the most common in Iran, Iraq, Syria and Tunisia. Although virus disease management can be achieved through combination of several approaches, development of resistant genotypes is undoubtedly one of the most promising control component. A total of 222 lentil and 360 faba bean genotypes were evaluated for their reaction to BLRV using artificial inoculation with the pea aphid *Acyrthosiphon pisum* under field conditions. Repeated inoculation and continuing reselection during four growing seasons lead to the identification of resistant genotypes. Six lentil genotypes (ILL 74, 75, 85, 213, 214, 6816) and 15 faba bean genotypes (from BPL 5271 until 5285) were found resistant to BLRV. The effectiveness of using seed treatment with imidacloprid (Gaucho®) to reduce BLRV incidence in faba bean and lentil was investigated. BLRV Incidence in faba bean was reduced from 92% in untreated plots to 23 and 13% in plots treated with 1.4 and 2.8 g a.i./kg, respectively. Moreover, the yield loss was reduced from 80% (untreated plots) to 14 and 7%, respectively. Results indicated that imidacloprid at 2.8 g a.i./kg reduced virus incidence in faba bean plants from 91.6% in untreated plots to 0.0%, when inoculated with BLRV two months after sowing. However, no effect was observed when virus inoculation was done three months after sowing. Moreover, imidacloprid seed treatment significantly improved lentil yield of moderately resistant and susceptible lentil genotypes, but had no effect on the yield of resistant genotypes.

V 5

INFECTION OF ALMOND TREES IN LEBANON BY A NEW PHYTOPLASMA DISEASE. Elia Choueiri[1], Eric Verdin[2], Jean L. Danet[2], Fouad Jreijiri[1], Souheir El Zammar[1], Ibrahim El Harfouch[1], Salah D. Issa[1], Pascal Salard[2], Joseph M. Bové[2] and Monique Garnier[2]. (1) Lebanese Agricultural Research Institute, Tal Amara, Rayak, Zahle, PO Box 287, Lebanon, E-mail: echoueiri@lari.gov.lb; (2) Institut de Biologie Végétale Moléculaire, INRA et Université de Bordeaux 2, BP-33883, Villenave d'Ornon Cedex, France.

Almond (*Prunus amygdalus*) has been cultivated in many regions in Lebanon since a long time especially in the Bekaa valley, in the north and south of Lebanon. In October 1999, during a survey conducted to evaluate the sanitary condition of stone fruits in Lebanon, symptoms of leaf yellowing, shoot proliferation and dieback were noticed on almond trees in the Bekaa region. In spring 2000, almond growers faced a problem of severe almond trees decline. Samples (cuttings and leaves) were collected and tested serologically for the presence of PNRSV, ApMV, PDV, ACLSV, CLRV, PPV, ToRSV and SLRV, but none was detected. The most prevalent symptom noticed on diseased trees was witches'-broom. Since such symptoms are often associated with phytoplasma diseases, samples were analyzed by PCR at the Molecular Laboratory of INRA-Bordeaux using universal primers for amplification of phytoplasma ribosomal RNA genes. DNA was extracted from the leaf midveins and/or bark phloem tissue from symptomatic and symptomless trees as well as from healthy trees. PCR resulted in amplification of an expected 1.8 kbp rDNA fragment from all symptomatic samples but not from the healthy or symptomless samples. The amplified DNA was further analyzed by RFLP for characterization. The restriction profiles were different from those of other phytoplasmas specially those infecting almond trees in Western Europe. Sequence analysis of the amplified DNA showed the almond phytoplasma to be a member of the pigeon pea witches' broom group (PPWB). The most severely affected areas were Raskifa and Dair Amar in the north of Lebanon. Trees died within two years after first symptoms appearance. The rapid spread of the disease and its phytolasma etiology suggests the presence of an insect vector. Epidemiological studies of the disease are being carried out to determine the vector in order to reduce the incidence of the disease and adopt an integrated control. This is the first report of a phytoplasma infection in Lebanon and the first report for a PPWB group phytoplasmas in almond trees.

V 6

IDENTIFICATION OF SOME BROABDEAN VIRUSES IN THE WESTERN REGION OF LIBYA. Solaiman Fadel[1], Jaber Khalil[2] and Mohamed Shagrun[2]. (1) University of Sabha, Faculty of Agriculture, Plant Production Department, Libya; (2) University of El-Fatah, Faculty of Agriculture, Plant Production Department, P.O. Box 13386, Tripoli, Libya, E-mail: khalil_reem@hotmail.com

Forty broad bean samples were collected in 1998/99 and 1999/2000 showing mosaic, vein clearing, chlorosis and leaf rolling, stunting, yellowing, leaf browning, mottle, necrosis, reddening and wilting. These samples were examined by three different ELISA tests using ten antisera for different viruses. Results indicated the presence of the following viruses: *Bean yellow mosaic* (BYMV), *Faba bean necrotic yellows* (FBNYV), *Pea seed-borne mosaic* (PSbMV), *Alfalfa mosaic* (AMV) and one unidentified luteovirus. Except for BYMV, these viruses are reported for the first time on broad bean plants in Libya.

V 7

TRANSMISSION OF *BARLEY YELLOW STRIATE MOSAIC VIRUS* (BYSMV) BY THE PLANTHOPPER VECTOR *LAODELPHAX STRIATELLA* (FALLEN) IN SYRIA AND LEBANON. Khaled M. Makkouk and Widad Ghulam, Virology Laboratory, Germplasm Program, ICARDA, P.O. Box 5466, Aleppo, Syria, E-mail: K.Makkouk@cgiar.org

Barley yellow striate mosaic virus (BYSMV, genus *Cytorabdovirus*, family *Rhabdoviridae*) is persistently transmitted by the planthopper *Laodelphax striatella* (Fallen) and reached to 58 and 79% in cereal disease summer nurseries in Syria (Sargaya station) and Lebanon (Terbol station) during 2002, respectively. Three different species of planthoppers were collected from ICARDA stations in Syria (Tel-Hadya, Aleppo) and Lebanon (Terbol station, Beqa'a Valley) and evaluated for their efficiency in transmitting BYSMV. Results showed that only *L. striatella* (Hemiptera: Delphacidae) transmitted BYSMV efficiently. BYSMV transmission levels were obtained, 52 and 90% in barley, 96 and 90% in wheat and 67 and 87% in oat, when using 6 and 48 hours for virus acquisition, respectively. Sixteen larvae and 20 adults of *L. striatella* fed on BYSMV-infected plants for 48 h, then each was transferred to a single wheat plant at daily intervals for 30 consecutive days. All plants were tested three weeks after inoculation for the presence of the virus by the tissue-blot immunoassay (TBIA). Results obtained indicated that 31% of the larvae and 25% of the adults transmitted the virus. The latent period of BYSMV in *L. striatella* varied from 6 to 17 days. There was a great variation in the infectious (viruliferous) period of individual planthoppers, which varied between 3-

24 days for larvae and 1-8 days for adults. Many individual insects (either larvae or adults) showed intermittent BYSMV transmission.

V 8

SEED TRANSMISSION OF *CUCUMBER MOSAIC VIRUS* IN LENTIL SEEDS IN SYRIA. Khaled Makkouk and Nouran Attar, Virology Laboratory, Germplasm Program, International Center for Agricultural Research in the Dry Areas (ICARDA), P.O. Box 5466, Aleppo, Syria, E-mail: K.Makkouk@cgiar.org

Twenty-two lentil genotypes obtained from ICARDA Gene-Bank were evaluated for their reaction to a Syrian isolate of *Cucumber mosaic virus* (CMV, genus: *Cucumovirus*, family: *Bromoviridae*) (SV36-86), and their ability to transmit it through their seeds. Plants were mechanically inoculated under field conditions with CMV at the early flowering and early podding stages during 2000/2001 growing season, and at the flowering stage during 2001/2002 growing season. Randomized samples (100 and 200 samples/genotype) were tested for CMV by Tissue-blot immunoassay (TBIA), three weeks after inoculation, during the two growing seasons. Results showed that CMV infection level was 7.4-35.8% in 2000/2001 and 7.0-64.2% in 2001/2002. When germinating embryo axes of seeds collected from CMV infected lentil mother plants were tested for the presence of CMV in groups of 20 seedlings each by the TBIA, the seed transmission rate of CMV was in the range of 0.9-9.5% in 2000/2001 and 0.1-1.7% in 2001/2002, in the genotypes evaluated. This is the first report of transmission of CMV in lentil seeds under Syrian conditions.

V 9

STUDIES ON CERTAIN VIRUSES IN CHICKPEA AND LENTIL IN NINEVAH PROVINCE. N.A. Kassim and J.M. Ahmed, Plant Protection Department, Agriculture College, University of Mosul, Iraq.

Bean yellow mosaic virus (BYMV) and *Bean leaf roll virus* (BLRV) were detected in chickpea crop, whereas BYMV and *Pea seed-borne mosaic virus* (PSbMV) were detected in lentil crop, for the first time in Iraq, by using TBIA test, agar double diffusion test, indicator plants and by lentil aphid transmission. Purification of BLRV was carried out following fractionation on a sephadex column, whereas BYMV was purified by differential centrifugation, following PEG precipitation of the virus. Callus from chickpea shoots and leaves were induced by using MS medium. This callus was infected by BYMV by high viberation.

V 10

VIRUSES CAUSING MOSAIC DISEASES OF PEPPERS IN NINEWAH PROVINCE. N.T. Younis[1] and N.A. Kassim[2]. (1) Biology Department, Science College, University of Mosul, Mosul, Iraq; (2) Plant Protection Department, Agriculture College, University of Mosul, Mosul, Iraq.

Surveys showed that high mosaic incidence (85%) in pepper fields is caused mainly by *Cucumber mosaic virus* (CMV), *Potato virus Y* (PVY) and *Tobacco mosaic virus* (TMV). Diagnosis of the individual viruses was based on their reaction on indicator plants, physical properties and serology. TMV was the only virus transmitted by pepper seeds at the rate of 11%. All three viruses were found to naturally infect weeds. Green peach aphid efficiently transmitted CMV and PVY. Natural infection with these viruses significantly reduced wet and dry weight and affected the content of nitrogen, phosphorus and potassium, and also reduced chlorophyll content by 70%. Using corn plants as barrier reduced infection. Spray with mineral oil reduced the rate of CMV and PVY transmission by aphids.

V 11

INTERACTION AND FREQUENCIES OF FABA BEAN SEED-TRANSMITTED VIRUSES UNDER NATURAL CONDITIONS. M.H. El-Hammady[1], S.E. Albrechtsen[2], A.M. Abdelmonem[3], F.M Abo El-Abbas[1], M.R. Rasmi[3] and W.S. Gazalla[1]. (1) Faculty of Agriculture, Ain Shams University, Cairo, Egypt; (2) Danish Government Institute of Seed Pathology for Developing Countries (DGISP), Thorvaldsensvej 57, DK-1871, Frederiksberg C, Copenhagen, Denmark, E-mail: seedpath@kvl.dk; (3) Plant Pathology Research Institute, Agricultural Research Center, Giza, Egypt, E-mail: dimam@link.net

Five seed-transmitted viruses, *Broad bean mottle (*BBMV), *Broad bean true mosaic* (BBTMV), *Broad bean stain* (BBSV), *Pea seed-borne mosaic* (PSbMV) and *Bean yellow mosaic* (BYMV), were detected by ELISA in faba bean plant samples collected from certain governorates in Egypt. Virus incidence differed among cultivars and seed sources with highest incidence in fields in southern regions. When young seedlings and adult plants were tested, BBMV was always the most prevalent virus. BBSV was not detected singly in young seedlings but occurred in few mature plants. BBMV and BBTMV were always detected as mixed infection. BBSV and BYMV were not detected together in young seedling but were found only in few mature plants. No triple virus infections were detected in young seedlings but were detected in mature plants.