sieve element phases (E1 and E2). Inversely, the good transmitting clone Sa1 feeds well on barley, with long sap ingestion periods, possibly allowing a better virus acquisition.

PAV and MAV transmission by Rhopalosiphum padi

Twenty-five *R padi* clones were tested for PAV and MAV transmission. They originated from different countries and continents (Europe, North America and North Africa) and exhibited different types of life-cycle (holocycle, anholocycle and androcycle). Concerning PAV4 transmission, we did not find any significant difference between clones, whatever the conditions of the experiments. The percentages of transmission were very high (90–100%) in optimal conditions (48 h acquisition/5 d inoculation) and lower (50–80%) when acquisition time or inoculation time were limiting (6 h). As regards MAV transmission, 2 isolates were compared, MAV2 (Le Rheu) and MAV11 (Versailles). MAV11 was only transmitted by 1 clone (Rp1: 3% transmission) and MAV2 was transmitted by 2 clones, Rp3 (25%) and Rp1 (10%).

Prado E, Tjallingii WF (1994) Aphid activities during sieve element punctures. *Entomol Exp Appl* 72, 157-165

Tjallingii WF (1978) Electronic recording of penetration behaviour by aphids. *Entomol Exp Appl* 24, 521-530

Van der Heuvel JFJM, Verbeek M, van der Wilk F (1994) Endosymbiotic bacteria associated with circulative transmission of potato leafroll virus by *Myzus persicae*. *J Gen Vir* 75, 2559-2565

Vector specificity of barley yellow dwarf (MAV, RPV) luteoviruses and virus regulation in aphids. JQ Guo [1], H Lapierre [2], JP Moreau [1] *([1] INRA, unité de zoologie; [2] INRA, unité de pathologie végétale, F-78026 Versailles cedex, France)*

The specificity and efficiency of barley yellow dwarf (MAV, RPV) luteoviruses were tested by using both 3 aphid clones of *Rhopalosiphum padi* L and *Sitobion avenae* Fabr in controlled conditions. All 3 clones of *R padi* and *S avenae* could transmit RPV and MAV, respectively, but vector efficiency was variable among them. Sa-R1 clone was a highly efficient vector (HEV), Sa-V clone was a moderately efficient vector (MEV) and Sa-R5 clone was a poorly efficient vector (PEV) within *S avenae* to transmit MAV. Rp-M and Rp-R26 clones were the HEV and Rp-CH clone was the PEV within *R padi* to transmit RPV.

In the serial transmission test, the 3 clones of *S avenae* and 2 HEV clones of *R padi* successively transmitted their respectively specific virus, MAV and RPV, until the last transfer at 13 d on barley, but the PEV Rp-CH clone transmitted RPV only up to 11 d transfer. After 5 d transfer, the vector efficiency declined obviously for all the clones. MAV and RPV contents in the aphids of 4 out of 6 clones decreased in triphase during the serial transfer, but the biphasic trend of MAV content and the monophasic trend of RPV content were involved in the virus regulation by the aphids of the PEV Rp-CH and the MEV Sa-V. In the triphasic trend, the initial decrease rapidly occurred after the first transfer, and then the virus content decreased slowly, but a relatively fast reduction appeared after 5 d transfer. In the biphasic trend, decrease rates of MAV content in the Rp-CH and Sa-V were nearly identical in each transfer of the second phase. In the monophasic trend, the decrease rates of RPV content were almost similar in every transfer until after 5 d transfer when the virus was no longer detected by ELISA in a batch of 10 aphids.

Detection by immuno-PCR revealed that MAV was retained by the aphids of tested clones until the last transfer at 13 d, except that Rp-CH retained it up to 11 d. RPV could be retained by the aphids of tested clones until the 13 d transfers, but Rp-CH and Sa-V retained it only to 11 and 9 d, respectively. Consequently, the reduction of MAV and RPV contents in the aphids was independent of the viruses that may be specifically transmitted during the serial transmission test. The moderate and poor vector efficiencies of Sa-V and Rp-CH clones were associated with the more rapid decrease of MAV and RPV contents in the aphids respectively. However, the poor vector efficiency of the Sa-R5 clone was not related to the reduction of virus content in the aphids. The selective barrier of accessory salivary glands (ASG) of aphids may determine vector specificity of MAV and RPV transmitted by *S avena* and *R padi* respectively, but clonal variations in vector efficiency within each species were associated with both the selective barrier of ASG and the capacity of virus retention by the aphids.

Assistance to long-distance transport between wheat yellow mosaic virus (WYMV) and soil-borne wheat mosaic virus (SBWMV) in bread wheat cultivars resistant to WYMV.

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SBWMV and WYMV have been mostly described in very distant areas in the same country. In fact these 2 viruses are found today in contiguous sites and sometimes in the same field. However so far not much work has been undertaken on interaction between these 2 viruses in wheat. Nevertheless, it has been shown that in the presence of the 2 viruses the resistance of some cultivars (cvs) to SBWMV could be broken down when they are susceptible to WYMV. SBWMV concentration in the shoots of cv Newton, which shows such a behaviour may be as high as those of susceptible cvs (Lommel *et al,* 1986).

In France, out of the susceptible cvs of wheat to SBWMV and/or WYMV only 3 cvs, Pernel, Promessa and Virlor, were found to be susceptible only to WYMV ($WYMV^s$) whereas the cvs susceptible to SBWMV were very frequent.

Under laboratory conditions, these 3 cvs were inoculated by soil carrying SBWMV and revealed a viral concentration in the roots, which might be as high as the susceptible cvs. However, in those 3 cvs there was no migration of the virus in the shoots.

In the field, in soil carrying only SBWMV, this virus was either not detected or was very difficult to detect in roots of these cvs. No foliar symptoms were observed and the virus was not detected in the leaves of the main stem at least up to the spring season.

In the case of co-infection with WYMV, SBWMV is not easily detected in the roots as compared to infection in plants by soil carrying SBWMV only. The plants of these 3 cvs were showing clear-cut mosaic symptoms and had a high WYMV concentration.

The behaviour of cvs Newton and Homestead (another American cv) of the type $SBWMV^r$ – $WYMV^s$ in USA were also studied in France in soils carrying SBWMV, WYMV or both viruses. The behaviour of these cvs was similar in France and the USA using soils carrying only 1 virus species. In soil carrying both viruses SBWMV was not detected in the leaves of the main stem of cv Homestead. However, in case of the cv Newton, a few plants were found to carry SBWMV during at least one phase of their vegetative growth.

Lommel SA, Willis WG, Kendall TL (1986) Identification of wheat spindle streak mosaic virus and its role in a new disease of winter wheat in Kansas. *Plant Dis* 70, 964-968

Localisation *in situ* du *maize streak virus* (MSV) dans un hybride sensible de maïs et une lignée resistante. L Bigarre [1], M Granier [1], B Reynaud [2], M Nicole [3], M Peterschmitt [1] *([1] CIRAD-CA, LPRC, BP 5035, F-34032 Montpellier cedex 1; [2] CIRAD-CA, 7, chemin de l'IRAT, F-97410 Saint-Pierre; [3] ORSTOM, laboratoire de phytopathologie, BP 5045, F-34032 Montpellier cedex 1, France)*

Les études génétiques de la résistance du maïs à la virose causée par le *maize streak virus* (MSV) ont abouti à l'hypothèse de 2 systèmes géniques distincts, l'un oligogénique déterminant une résistance totale et l'autre polygénique déterminant une résistance partielle. Le cumul des 2 types de résistance présenterait un avantage indéniable aux plans de la qualité et de la durabilité de la résistance. Pour atteindre cet objectif, une connaissance plus précise des résistances est nécessaire tant au niveau de leur déterminisme génétique que de leurs mécanismes physiologiques. Outre la cartographie des gènes de résistance amorcée récemment, une étude histo- et cyto-pathologique a été entreprise sur l'hybride sensible Sabrina et sur la lignée partiellement résistante D212 par observation en microscopie électronique et photonique, et par immunocytochimie.

Au plan cytopathologique, les tissus infectés de l'hybride sensible mais également de la lignée résistante montrent des modifications profondes qui touchent la structure des organelles. Les chloroplastes présentent une désorganisation interne, visible par des relâchements des thylacoïdes et une diminution de la quantité d'amidon. Dans les noyaux, on note une réorganisation importante de la chromatine qui se redistribue principalement à sa périphérie. Les nucléoles sont généralement denses, hypertrophiés et associés à des structures fibrillaires sphériques probablement composées d'acide nucléique.

Le marquage immunocytochimique à l'or colloïdal des protéines de la capside révèle que les virions sont organisés en amas pseudo-cristallins, aussi bien chez l'hybride sensible que chez la lignée résistante. Ils sont localisés dans le noyau et parfois dans le cytoplasme de tous les types cellulaires de la feuille, excepté les vaisseaux du xylème. La résistance ne semble pas avoir d'effet sur la répartition du MSV dans les différents types cellulaires. Les amas de virus