DISTRIBUTION OF PEANUT CLUMP VIRUS (PCV), A VIRUS WITH HIGH SYMPTOM VARIABILITY

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Summary

In 1974, Peanut Clump disease was present only in two very localized places in West Africa: Area of Bambey in Senegal and one agricultural research station in Burkina Faso. Following a number of surveys made in the 80s up to 1991, Peanut Clump Virus (PCV) was detected in Côte d'Ivoire, Mali, Niger and Benin. In Senegal, the virus is now widely distributed from the Senegal river to the frontier of Gambia. Transmission of PCV through seeds is partly responsible for the increased spread of the disease. Abundance of PCV in agricultural research stations, or in seed-gardens shows the importance of seed transmission. Existence of infected soils is another factor of dissemination of the virus. Symptoms induced by PCV in a given variety of groundnut vary from classical stunting with small dark green leaves, to normal sized plants with different light leaf symptoms such as line pattern, specking and a great variety of other foliar symptoms. Therefore, PCV is very difficult to diagnose in the field.

Introduction

Peanut Clump was described for the first time in Senegal in 1931 by Trochain, in a very limited groundnut growing area between Diourbel and Bambey. The disease remained localized in this region up to the beginning of the 70s, when it was reported at the Saria agricultural station, Burkina Faso (Germani and Dhery, 1973). At that time, the disease was described by a unique symptomatology: severe plant stunting, with small, dark green leaves and short internodes. It was on plants with such symptoms that PCV was identified then characterized (THOUVENEL *et al.*, 1976). DOLLET *et al.* (1976) showed that sorghum, was a natural PCV host and that the virus was transmitted via the soil from infected sorghum roots. *Polymixa graminis* is the presumed vector of PCV (THOUVENEL and FAUQUET, 1981).

At the beginning of the 80s, one of us (J.D.) observed viral leaf symptoms which had not yet been described in Senegal. Surveys were then carried out in Senegal from 1986 to 1990, in Niger (1989) and Burkina Faso and Mali (1991).

Materials and Methods

In Senegal, one or two groundnut fields were visited every ten km. In Burkina Faso and Mali, 4 to 5 fields were surveyed around every 50 km. Samples consisted of 1 to 3 branches placed in a carefully sealed plastic bag and put into a portable ice-box. In Montpellier, the samples were grafted onto a single variety of groundnut -69101-. The plants were kept in a climatic chamber at a temperature of 29-30°C during the day and 24-25°C at night.

Soil (10 to 50 cm horizon) was collected and taken to the ORSTOM nematology laboratory in Dakar. Seeds of the Florunner groundnut variety from the United States (where there is no PCV) were sown 4 to a pot.

The existence of PCV was checked successively by 1) physical inoculation on *Chenopodium amaranticolor*, 2) Leaf-Dip examination under the electron microscope and 3) possible serological test with polyclonal antibodies by micro-precipitation.

Results

In Senegal, PCV was found not only in the region of Bambey, but also in the Cap Vert Region, the Thies Region, in Siné Saloum and on irrigated land along the Senegal river. PCV was present on research stations (Bambey, Thyssé-Kaymor), but also in smallholdings (Pout, Mbour) or large plantations (Kirene) (Fig. 1).

In Burkina Faso, PCV was found at Saria and Kamboinsé to the North of Ouagadougou. Clump symptoms have been reported in the Koupéla region and between

Bobo Dioulasso and Niangoloko. To the north of Ouagadougou, numerous smallholdings are affected by PCV (G. Konate, personal communication) (Fig. 2).

In Mali, PCV was identified for the first time at the Cinzana research and seed multiplication station near Ségou. Numerous cases of stunting were observed between Koutiala and Bamako and to the South of Bamako, though the virus was not identified (Fig. 3). These PCV "non-identifications" in stunted groundnut plants were due either to graft death during the first attempts at grafting, or to non-transmission of the symptoms observed in the field.

In Niger, the surveys carried out primarily by ICRISAT revealed the existence of clump in the Maradi region and near Niamey. During these various surveys, PCV was identified in the stunted groundnut plants with typical clump symptoms, but also in normal sized plants without short internodes but with various leaf symptoms: chlorotic patches or rings more or less in the form of an eyespot, geometric, angular, yellow line patterns, yellow specking, yellow mosaic, green blotches (Fig. 4). These symptoms were sometimes very slight or localized solely on the oldest leaves hidden by the tuft of younger leaves and PCV therefore escaped detection. It worth noting that the greatest symptomatological variability is found at research stations.

The detection of groundnut plants infected by PCV 3 weeks after sowing, in a plot at Ndiongo (Senegal river) in which neither groundnut nor sorghum had been grown before led us to test soil infectivity in a glasshouse in Dakar. The groundnuts sown in this soil were contaminated by PCV, which showed that the inoculum was present in the soil, despite no prior groundnut or sorghum cultivation.

Discussion

PCV has spread from pinpoint localization in the 70s to widespread dispersal virtually throughout Senegal and into several West African countries.

Detection of this dispersal was accompanied by the discovery of extensive symptomatological variability. Several explanations can be considered. The first is transmission of the virus by seeds. Such transmission may be all the more difficult to avoid in that certain groundnuts affected by PCV sometimes reveal very few, or atypical symptoms. Finally, it may be that the inoculum (vector-virus) exists in numerous soils, probably due to wild grasses. The first investigations carried out on these grasses showed that several of them were infected by PCV (unpublished results). In the traditional cropping system, traditional groundnut-sorghum rotations in sub-Sahelian countries are undoubtedly propitious to inoculum multiplication.

These surveys, conducted since 1986, therefore opened up new horizons in the study and understanding of PCV. Extensive serological variability has already been discovered (HUGUENOT *et al.*, 1989, MANOHAR *et al*, 1993 a), along with substantial genomic variability (MANOHAR *et al*, 1993 b). Finally, however, it should be noted that not all stunted groundnut plants harbour PCV. We have discovered at least three viruses (two flexuous and one spherical) associated with stunting symptoms (unpublished results).

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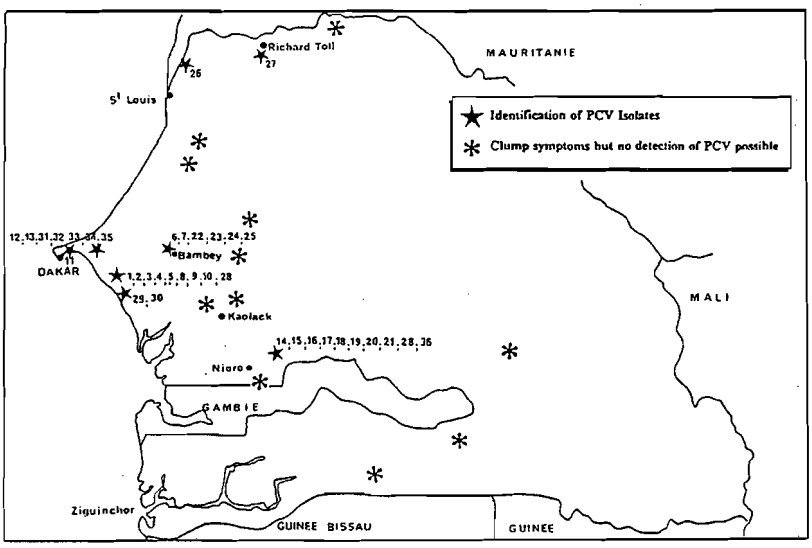

Fig. 1 PCV distribution in Senegal in 1990. Numbers represent each isolate collected during the surveys.

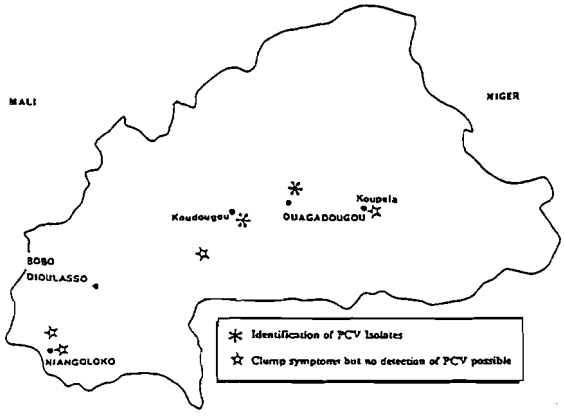

Fig. 2 PCV distribution in Burkina Faso in 1991.

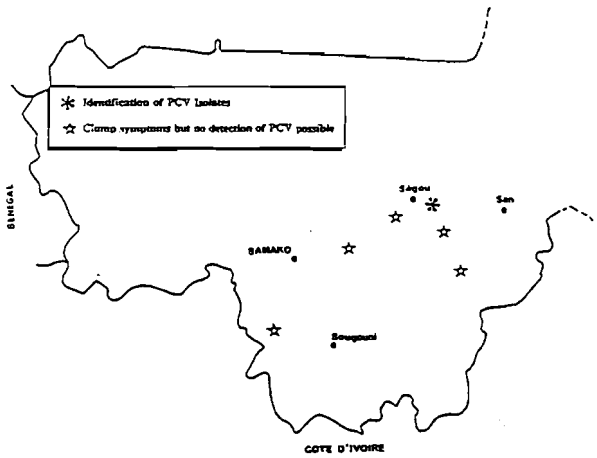

Fig. 3 PCV distribution in Mali in 1991.

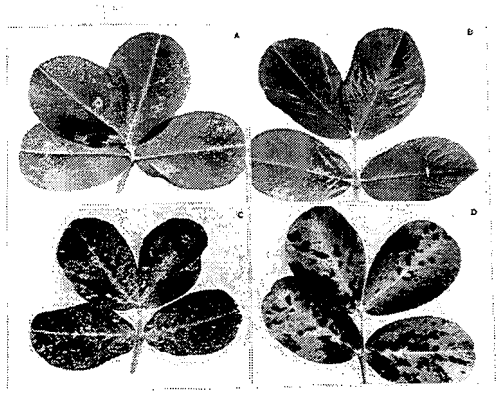

Fig. 4 Examples of PCV symptom variability observed on the variety 69101. A chlorotic rings, B yellow angular line pattern, C yellow specking, D green blotches.