

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-Diourbel in Sénégal and one agricultural research station near Koudougou in Burkina Faso. Following a number of surveys made in West Africa in the 80s up to 1991, Peanut Clump Virus (PCV) was detected in Côte d'Ivoire, Mali, Niger and Benin. In Sénégal, the virus is now widely distributed from the Sénégal river to the frontier of Gambia. PCV is now an important problem for sugarcane cultivation too. Transmission of PCV through seeds (groundnuts) or cuttings (sugarcane) is partly responsible for the increased spread of the disease in West Africa. Abundance of PCV in agricultural research stations, or in seed-gardens like in Sénégal or Mali 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 disease was described for the first time in Sénégal 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 near Koudougou, 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 (BOUHOT, 1967). It was on plants with such symptoms that Peanut Clump Virus (PCV) was identified then characterized (THOUVENEL *et al.*, 1976). DOLLET *et al.* (1976) showed that sorghum, a plant used in crop rotations, 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 on groundnut in Sénégal. Joint surveys were then carried out by CIRAD and ORSTOM in Sénégal from 1986 to 1990, and with ICRISAT in Niger (1989), then Burkina Faso and Mali (1991). More than 100 isolates were brought back to the LPRC, where they were studied.

Materials and Methods

Surveys and sampling

In Sénégal, one or two groundnut fields were visited every ten kilometres. 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.

Collection

In Montpellier, the samples were grafted onto a single variety of groundnut -69101-. The plants were kept in an insect-proof glasshouse, or in a climatic chamber at a temperature of 29-30°C during the day and 24-25°C at night.

Soil transmission trial

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.

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Check for PCV existence

The existence of PCV in groundnut 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 Sénégal, PCV was found not only in the region of Bambey, but also in the Cap Vert Region (Rufisque, Pout), the Thies Region (Kirene, Mbour), in Siné Saloum (Thyssé-Kaymor) and on newly irrigated land along the Sénégal river. The virus 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 (Sénégal 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 Sénégal 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 (TROCHAIN, 1931). We have obtained transmission rates of 19% with an isolate from Sénégal. Such transmission may be all the more difficult to avoid in that certain groundnuts affected by the virus sometimes reveal very few symptoms, or atypical symptoms. Finally, it may be that the inoculum (vector-virus) exists in numerous soils even beyond areas of groundnut or sorghum cultivation, 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-Saharan 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), along with substantial genomic variability (MANOHAR *et al.*, 1993). Finally, however, it should be noted that not all stunted groundnut plants harbour PCV. We have discovered at least three new viruses (two flexuous and one spherical) associated with stunting symptoms (unpublished results).

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Fig. 1 PCV distribution in Sénégal in 1990. Numbers represent each isolate collected during the surveys and brought back to Montpellier.

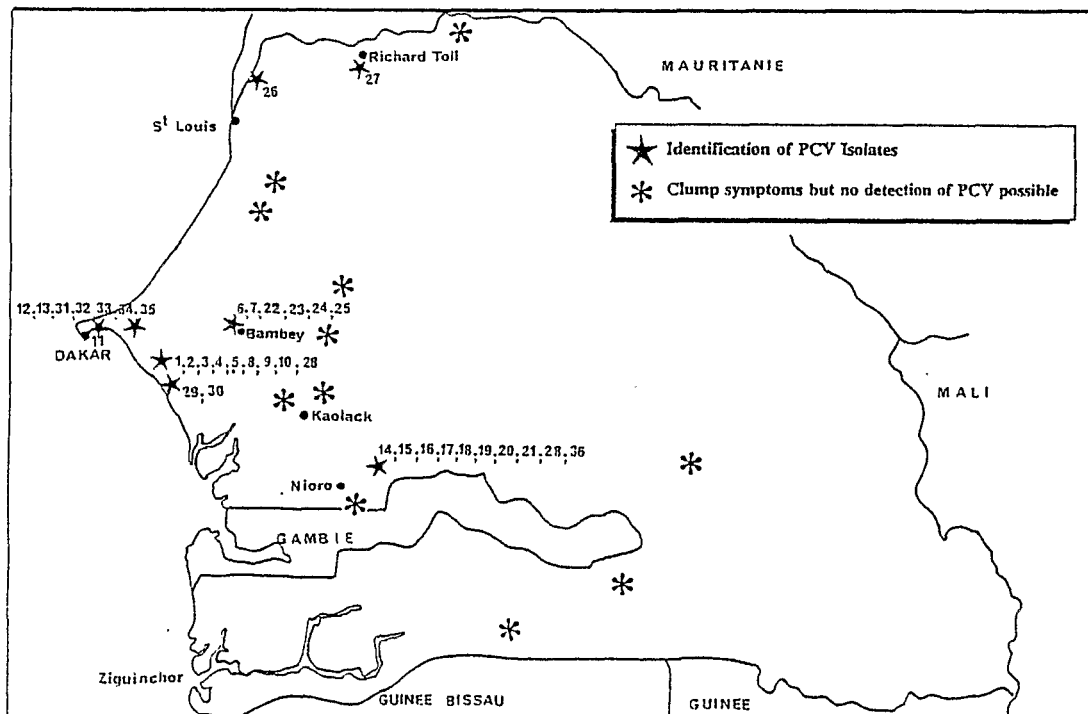


Fig. 2 PCV distribution in Burkina Faso in 1991.

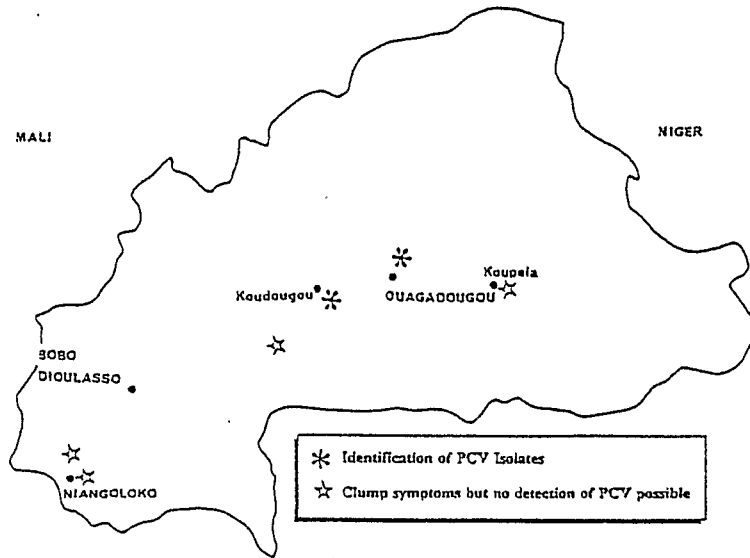


Fig. 3 PCV distribution in Mali in 1991.

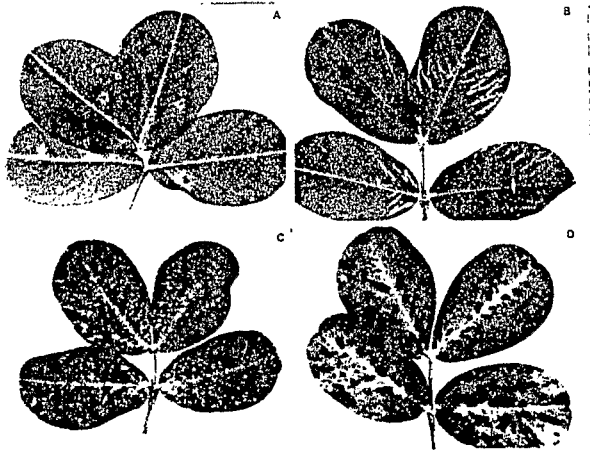
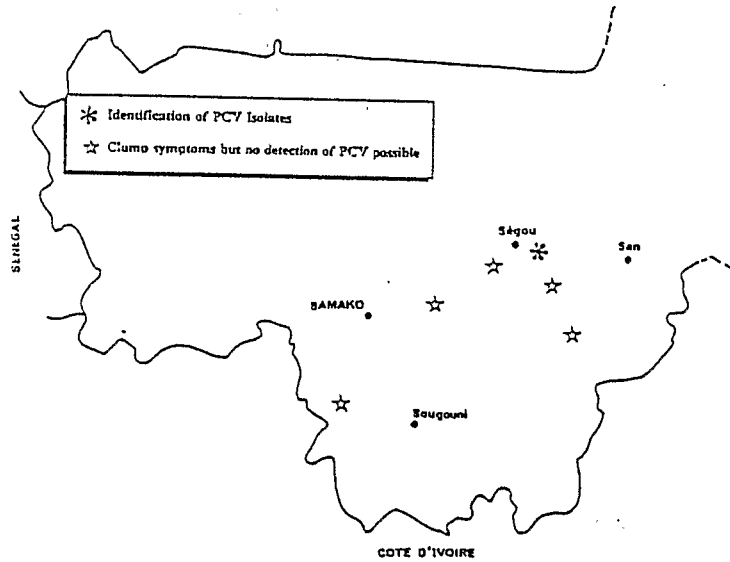


Fig. 4

Examples of PCV symptom variability observed on the leaves of groundnut variety 69101. A chlorotic rings, B yellow angular line pattern, C yellow speckling, D green blotches (all normal sized leaves, plants with no stunting).

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