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Citrus tristeza virus and its vectors in Northern Sudan

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Abstract. Most of citrus varieties in Sudan have been imported from other citrus improvement programmes particularly USA and Spain. This germplasm has also been maintained in varietal collections and found CTV-free. *Toxoptera citricidus* is apparently present only in the Southern and Western part of Sudan, whereas in 2005 CTV was firstly reported in the Northern area of Sudan.

Keywords. Citrus – CTV – *Toxoptera citricidus* – Sudan.

Le virus de la Tristeza des agrumes dans le nord du Soudan

Résumé. La plupart des variétés d'agrumes introduites au Soudan proviennent des programmes d'amélioration du matériel végétal réalisés dans d'autres pays, en particulier des Etats-Unis et d'Espagne). Ces ressources phytogénétiques, exemptes du CTV, ont été conservées dans des collections variétales. Le *Toxoptera citricidus* n'est apparemment présent que dans le sud et dans l'ouest du Soudan, alors que le CTV a été signalé pour la première fois en 2005 dans le nord du pays.

Mots-clés. Agrumes – CTV – *Toxoptera citricidus* – Soudan.

I – Introduction

There is a high potential for citrus expansion in Sudan. Grapefruit, lime and mid and late sweet orange varieties perform well under Sudan conditions. The citrus plantings grown in Sudan are mainly of the following species and varieties: Beladi lime, grapefruit, mainly foster pink but also marsh seedless, Valencia-like Beladi sweet orange and willow-leaf mandarin.

Almost all citrus trees commercially grown in Sudan are old lines. These were introduced from Egypt, Palestine, Trinidad, USA, Kenya and Rhodesia (Bové, 1988). Old lines are known to be infected with virus and virus-like diseases (Roistacher, 1991). In the period 1967-1970 diverse introductions occurred from California, USA, but were not cultivated commercially. Most of the trees are on sour orange rootstock while Beladi lime is propagated from seeds. In 1995, a new virus-free budwood collection was introduced from the National Repository of Citrus and Dates of Riverside, California, USA and IVIA, Spain. This collection is kept at Shambat Research Station (Mohamed, 2001). The collection includes introduced citrus varieties (Tab. 1), rootstocks Troyer and Carrizo citrange, Rough lemon, Volkameriana lemon and *Citrus macrophylla* and the standard indicator plants.

Table 1. List of the introduced citrus varieties.

Species	Cultivar	Source	Year
	Frost Marsh	Riverside, CA	1995
	Shamber	Riverside, CA	1995
	Rays Ruby	Riverside, CA	1995
	Hudson foster	Riverside, CA	1995
	Rio Red	(IVIA, Spain)	2002
Sweet Orange	Olinda	Riverside, CA	1995
	Cutter	Riverside, CA	1995
	Campbell	Riverside, CA	1995
	Gillette	Riverside, CA	1995
Mandarin	Willowleaf	Riverside, CA	1995
	Honey	Riverside, CA	1995
	Clementine	Riverside, CA	1995
	Wilking	Riverside, CA	1995
	Kinnow	Riverside, CA	1995
Lime	Bears	(IVIA, Spain)	2002

II – Historical review of CTV and its vectors

1964. Childs (1964) surveyed the disease status of citrus plantings. He mentioned a few suspected CTV infected trees in Northern Sudan. *T. citricidus* was reported by this author in Western and Southern Sudan but not in the North.

1969 - 1983. The previous observations regarding *T. citricidus* were confirmed by Schmutterer (1969) and Krezdron (1983). Schmutterer refers the existence of legislation aiming to prevent the introduction of pests and diseases of crops from foreign countries. Imported plants and fruits are inspected by the plant quarantine service in offices along the borders and in the capital airport. Other laws aiming to reduce the possible sources of infection were established.

1986. Bové (1988) examined several lime trees and found no symptoms of CTV infection. He came to the conclusion that, at the time of his survey, natural spread of CTV was probably not occurring or at least not to a large scale. The reason for this might have been the absence of the tropical citrus aphid *T. citricidus*, in northern Sudan.

1997. A survey by using Immunoprinting test (Garnsey *et al.*, 1993), was carried out in the Gezira State targeting the citrus germplasm introduced in 1995 (Mohamed, 2001). No evidence of CTV infection was found. later, 3 trees of Foster Pink grapefruit and Nuri 16 clone, a local sweet orange variety, were indexed by grafting onto acid lime. There was no evidence of the disease, as judged by the absence of stem pitting or leaf vein clearing.

2005. More recently, Abubaker *et al.* (2005) reported the presence of CTV in a survey carried out in the northern State. The virus was detected in 13 samples of sweet orange and in one sample of each mandarin and lime by using a mixture of 3DF1 and 3CA5 antibodies (Plantprint Diagnostics, Spain). While, an RT-PCR approach substantiated the presence of CTV in four trees (3 sweet orange and one lime) which had tested positive by serological tests.

Surveys for *T. citricidus* (Dr. Mousa Abdalla and Dr. Ahmed Hassan, Agricultural Research Corporation, Sudan, Personal Communication) showed no evidence of the aphid in central and northern Sudan. *Aphis gossypii*, the cotton aphid, and *A. craccivora* are present in Northern Sudan.

Sweet orange introductions had been received from Kenya and Rhodesia. Citrus in these countries is known to be infected with citrus tristeza virus (Bové, 1988). Hence, some CTV- infected trees of Kenyan or Rhodesian origin might have been propagated in Sudan.

III – Present concerns and suggested activities for the CTV control

The recent report of Abubaker *et al.* (2005) confirming the presence of CTV in Northern Sudan is very alarming because i) sour orange is the main rootstock used in Sudan, ii) acid lime is grown extensively iii) beside *T. citricidus*, other aphid vector species are widely distributed.

The presence of *T. citricidus* in Southern and Western Sudan, which is known for its high adaptability to various climatic conditions and its rapid spread, is also alarming.

Others reported the wide occurrence of citrus excoctis disease in local germplasm, a situation that would not freely allow the use of alternative CTV-tolerant rootstocks to control the disease as is the case with citranges. Every effort should be made to contain the disease and prevent its spreading.

IV – Proposed measures to address the situation of CTV

- i. Delimiting survey to define the extent of CTV spread and distribution. CTV strains typing as early as possible and destruction of infected trees.
- ii. Regular CTV vectors survey and management.
- iii. Strengthening the on growing virus-free citrus budwood project
- iv. Indexing citrus germplasm, to ensure CTV freedom and conserve the germplasm under protected conditions.
- v. Evaluating an alternative to the sour orange rootstock
- vi. Enforcing quarantine measures and regulations.
- vii. Prohibition the importation of budwood from countries where CTV occurs and fruits imported should be either free from peduncle and leaves,
- viii. Education and extension program to raise the awareness of the danger of CTV to citrus cultivation.
- ix. Establishment of cooperative relations with regional and international citrus improvement and certification networks.

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