

Orange Rust (*Puccinia Kuehnii*) In Colombia: Presence and Management Strategies

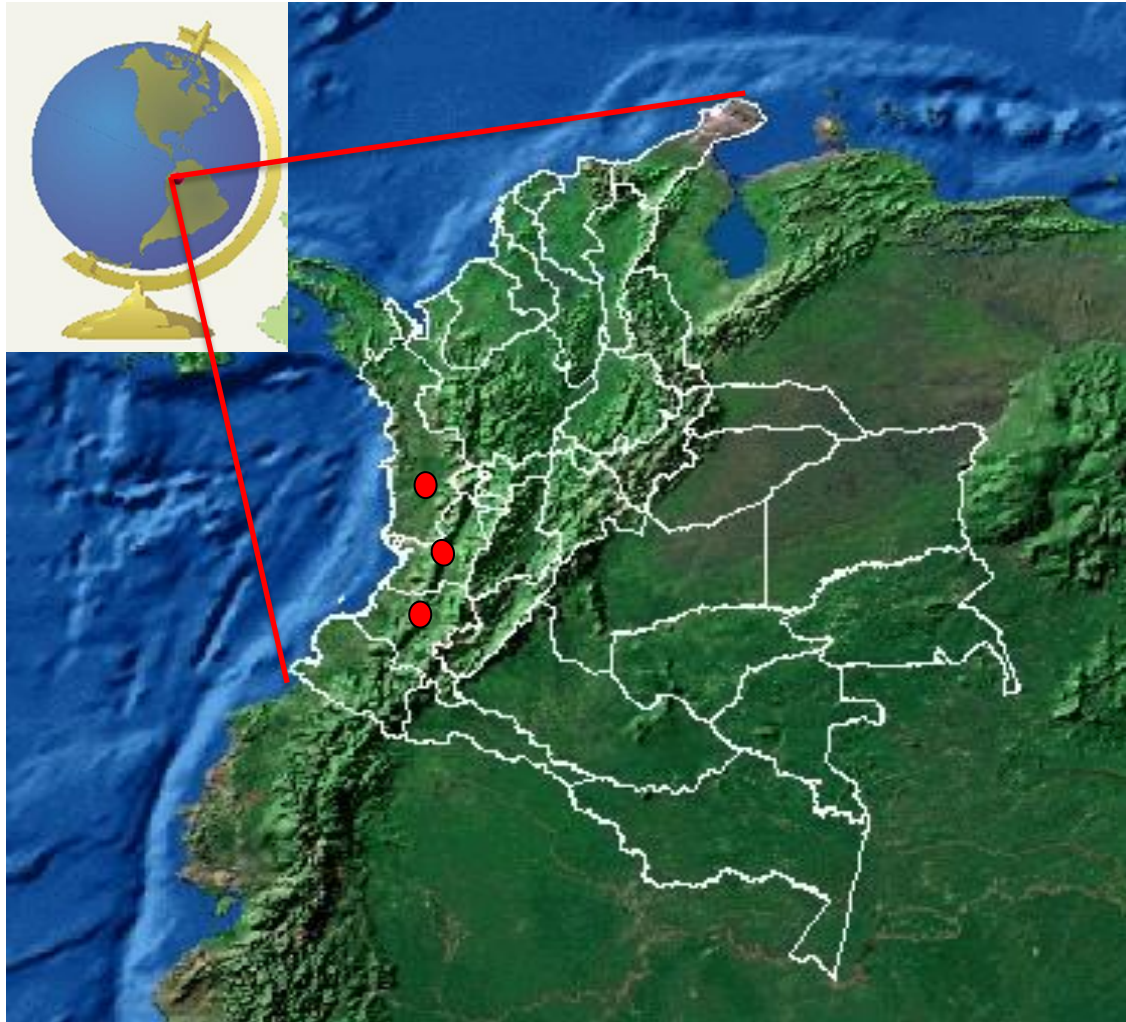


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Presenter: John J. Riascos



Relevance



220.000 ha. 2011, sugar and ethanol



225.000 Ha. panela



Orange Rust

Presence and Diagnosis



Orange Rust in America

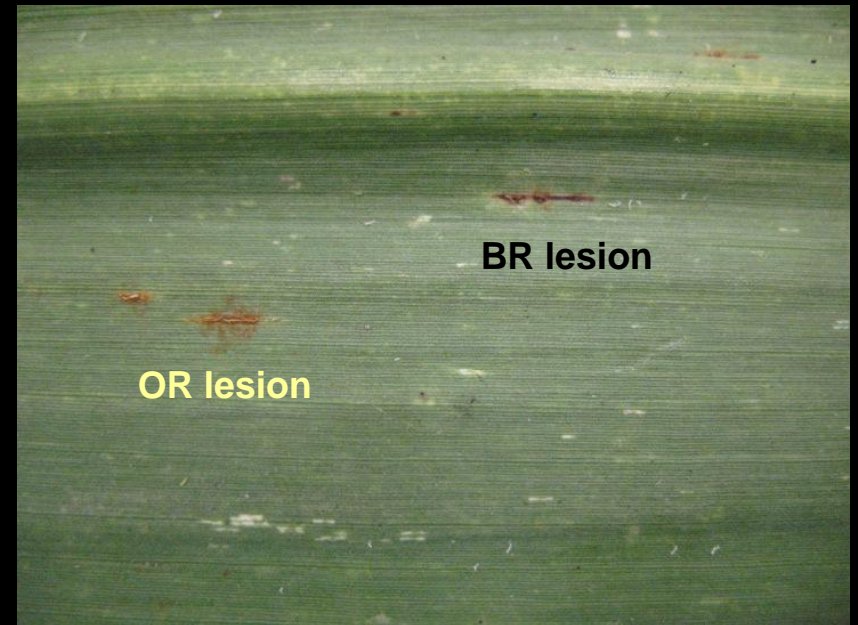
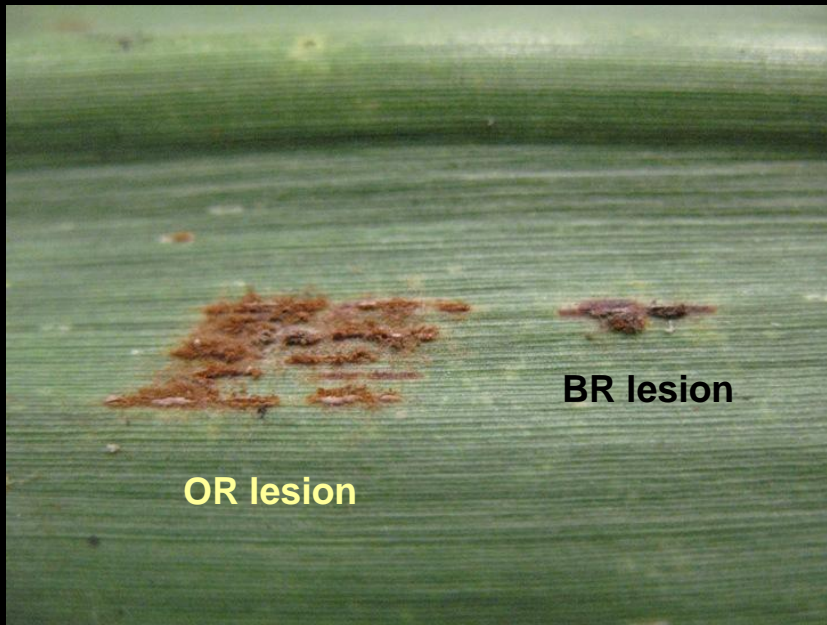


Cadavid et al., 2012. Plant disease. 96(1): 143.

Diagnosis and Management in Colombia

Orange rust + brown rust

CC 97-7170



Diagnosis and Management in Colombia

Brown Rust



Orange Rust



Diagnosis and Management in Colombia



1. small lesions, long and yellow, forming a halo pale yellow-green



2. Lesions increase in size. The lesions grow and become colored orange and orange dark



3. Groups of pustules (spores) orange color

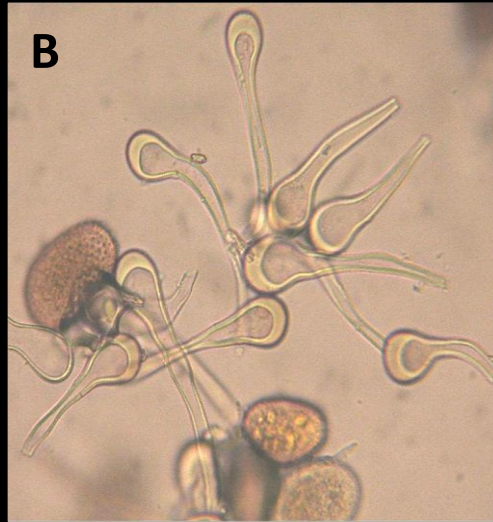
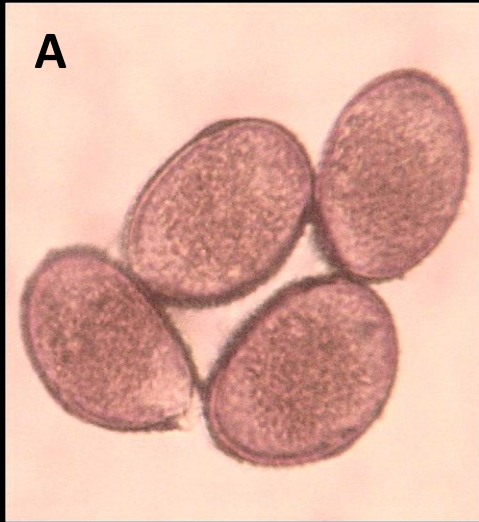


4. Old lesions can become dark brown

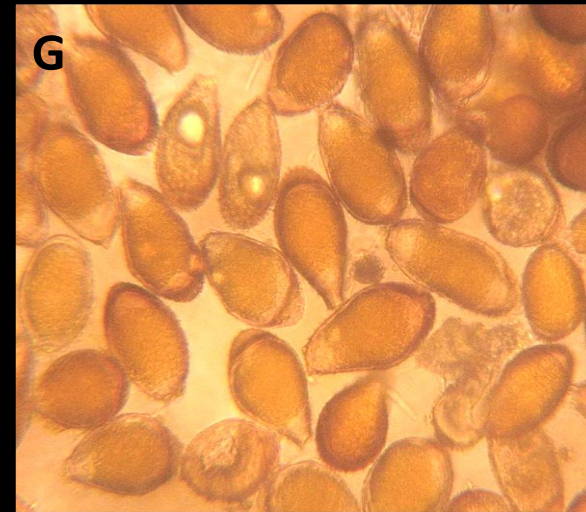


Differences at the light microscope

Brown Rust
CC85-92 (40X)



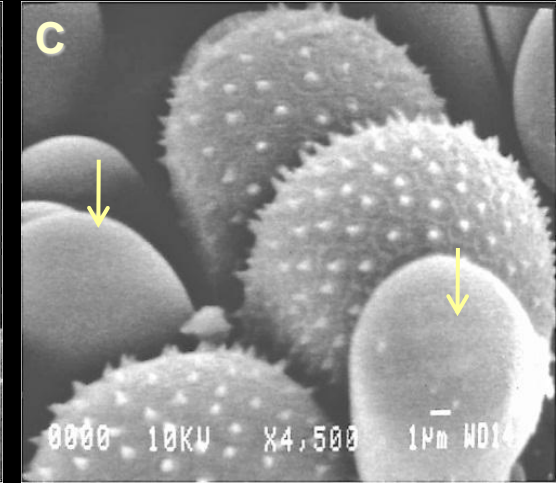
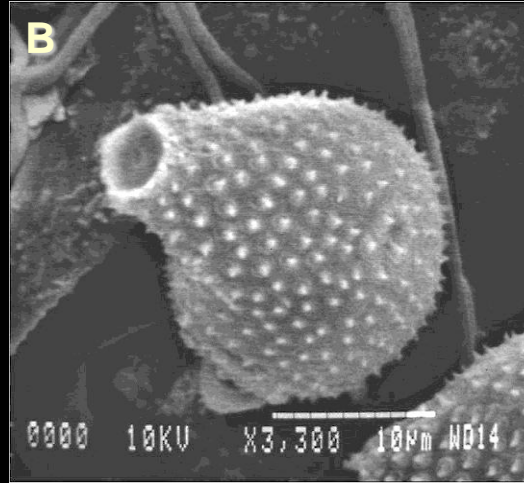
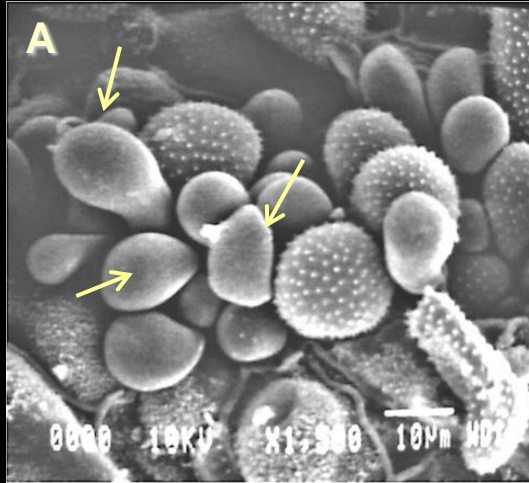
Orange Rust
CC01-1884 (40X)



Differences at the screening electron microscope (SEM)

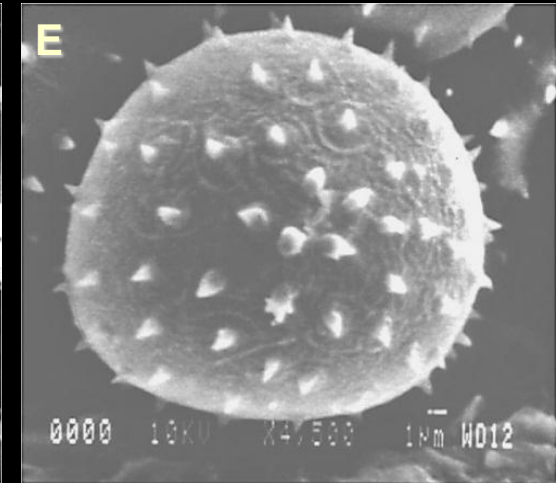
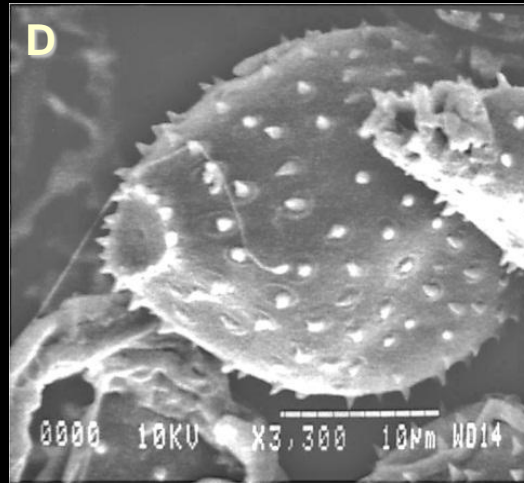
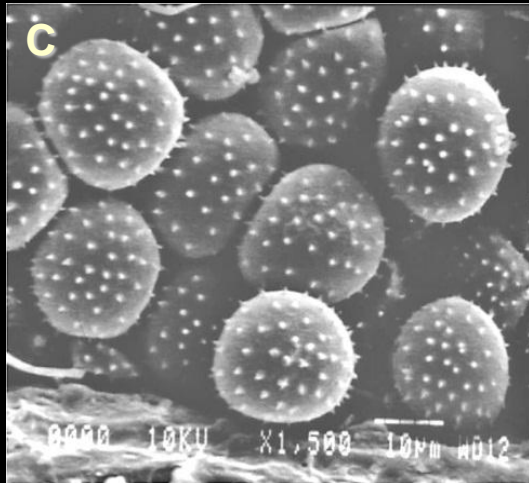
Brown Rust

CC85-92



Orange Rust

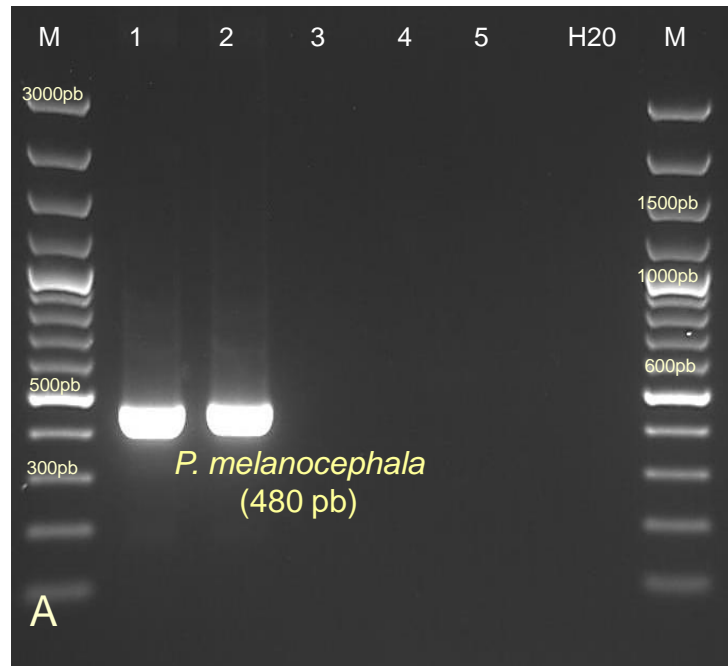
CC01-1884



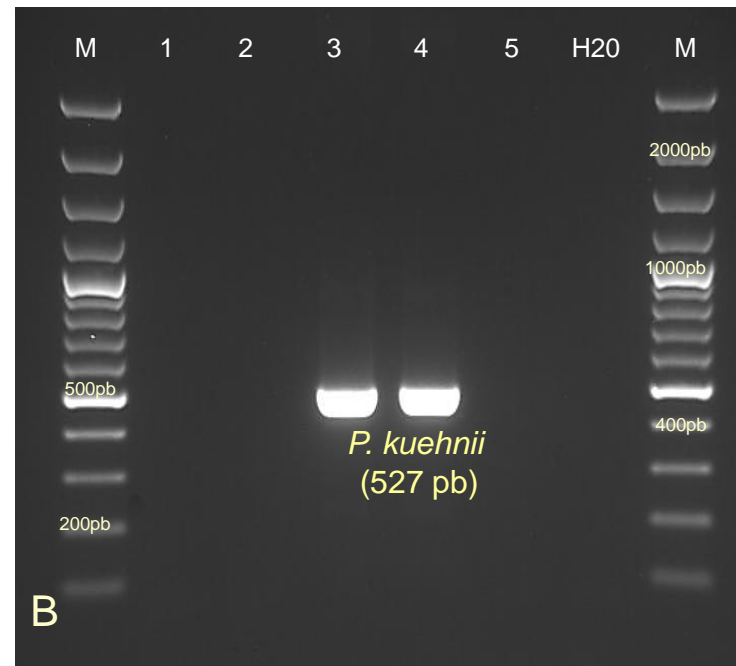
Confirmation of these two species was also obtained by the Mycological Museum of Colombia (Universidad Nacional, Medellin)

Molecular (PCR) evidence

Primers: Pm1F/Pm1R



Primers : Pk1F/Pk1R



1 y 2: CC 85-92 showing symptoms of brown rust. **3 y 4.:** CC 01-1884 showing symptoms of orange rust

6. H₂O (Blank). **M:** 100bp DNA Plus Ladder

Glynn et al., (2010) Plant Pathology. (59): 703-711



Orange Rust Management Strategies



Field diagnosis

Identification of symptoms



Collection of samples

- ✓ Third leaf
- ✓ 20 leaves at random
- ✓ Evaluation using scale by Purdy and Dean (1980)

Field evaluation

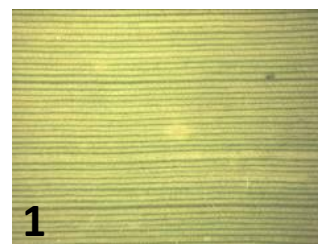
- Clones trials, stages I, II And III
- Commercial varieties , 2010
- Commercial varieties, 2011
- Germplasm bank
- 1-12 months of age



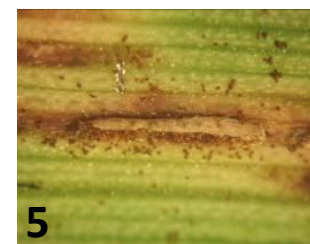
Scale by Purdy and Dean (1980)

Response (R)	Response description
0	No visible infection, rust present in area.
1	Chlorotic flecks only.
2	Chlorotic flecks with red or brown centers. Centers may be necrotic.
3	Small to large irregularly shaped red to brown spots that may coalesce. Pustules absent.
4	Individual chlorotic or red spots with nonopened pustules.
5	Individual chlorotic or red spots with pustules opened and producing spores.
6	Blotches of leaf reddened or necrotic with pustules producing spores.
7	Coalesced red to brown blotches or spots covering much of leaf surface from leaf edge to midrib, may be on both sides of midrib, and with pustules that are producing spores.
8	Pustules producing spores on chlorotic tissue, pustules with chlorotic halos.
9	Pustules producing spores on green tissue.

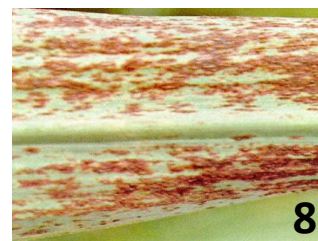
Response (R)



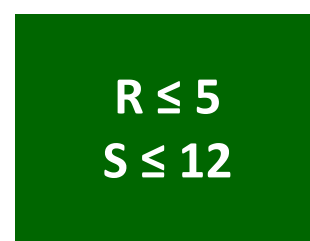
1



5

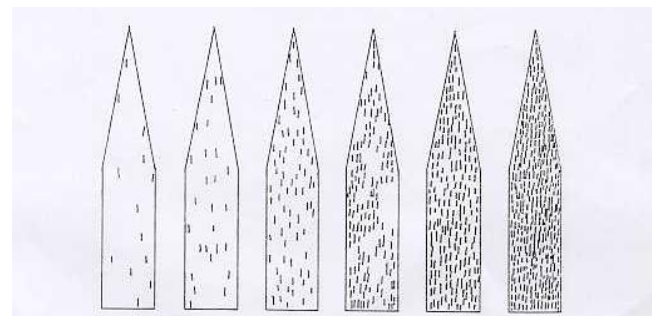


8



$R \leq 5$
 $S \leq 12$

Severity (S) (%)



1 5 10 15 25 50



Regional trials - Humid zone

Variety	Sugarcane Mills													
	Cauca		Cabaña		Riopaila		S. Carlos		Castilla		Risaralda		Carmelita	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S
CC 01 - 1884	5	2	7	15	5	1	5	15	7	10	0	0	5	10
CC 01 - 1866	0	0	0	0	0	0	5	4	5	2	0	0	5	1
CC 01 - 1817	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 01 - 1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 01 - 1940	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 85 - 92	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>



Regional trials – Dry and semidry zones

Variety	Sugarcane Mills					
	Riopaila		S. Carlos		Providen.	
	R	S	R	S	R	S
CC 01-1305	6	15	6	15	6	20
CC 01-746	5	10	0	0	5	2
CC 97-7565	5	1	0	0	5	7
CC 00-3068	5	1	0	0	5	4
CC 01-1484	4	2	0	0	5	2
CC 00-3191	4	2	0	0	5	1
CC 97-7170	5	1	5	1	5	2
MZC 74-275	5	1	5	1	5	1
CC 98-426	5	1	5	1	5	1
CC 85-92	0	0	0	0	0	0

Variety	Sugarcane Mills					
	Riopaila		S. Carlos		Providen.	
	R	S	R	S	R	S
CC 99-1405	4	1	0	0	5	1
CC 00-2924	0	0	0	0	0	0
CC 01-1228	0	0	0	0	0	0
CC 01-678	0	0	-	-	0	0
CC 01-1789	0	0	0	0	0	0
CC 01-1508	0	0	0	0	0	0
CC 00-3079	0	0	0	0	0	0
CC 01-1567	0	0	0	0	0	0
CC 00-2639	0	0	0	0	0	0
CC 85-92	0	0	0	0	0	0



Regional trials - All zones summary

Stage	Zone	% Brown rust	% Orange rust
III (08-09)	Dry-Semidry	8.0	5.2
II (2009)		19.0	0.0
II (2010)		35.6	1.3
I (2011)		10.6	0.2
I (2013)		1.9	0.0
III (2009)	Humid	20.0	0.0
II (2010)		29.9	0.2
I (2013)		4.9	0.0



Commercial fields and nurseries (2010)

Variety	R	S
CC 01-1305	7	30
CC 97-7565	5	2
CC 97-7170	5	1
CC 00-3068	5	1
CC 01-746	5	1
CC 84-75	0	0
CC 85-92	0	0
CC 92-2198	0	0
CC 92-2804	0	0
CC 93-3826	0	0
CC 93-3895	0	0
CC 93-4181	0	0

Variety	R	S
CC 93-4418	0	0
CC 01-1228	0	0
CC 94-5827	0	0
CC 01-1484	0	0
CC 01-1922	0	0
CC 01-1940	0	0
CC 01-3079	0	0
CC 01-678	0	0
CC 98-72	0	0
CC 03-154	0	0
V 71-51	0	0





CC01-1305

Commercial fields and nurseries (2011)

Variety	# Var. evaluated	Brown rust	Orange rust
Commercial	4	2	0
Semicommercial	4	1	0
Nurseries	34	9	0

All positives for **Brown rust** had $R \leq 5$ and $S \leq 12$



Evaluation of germplasm bank

Disease	# of varieties showing the disease	% of varieties showing the disease
Brown rust	494	36,5
Orange rust	126	9,3
Brown rust+Orange rust	60	4,4
None	645	47,7
Not evaluated	29	2,1
Total	1354	100

Positives for **Orange rust** had **R** ≤ 2-8 and **S** ≤ 8-30



Selection of promissory clones based on:

Smut

(Sporisorium scitamineum)



Brown rust

(Puccinia melanocephala)



Mosaic

(Mosaic potyvirus)



Orange rust

(Puccinia kuehnii)



Extension (2010-12)

Recognition and management strategies:

- ✓ Sugarmills: 13
- ✓ Cenicaña
- ✓ Farmers
- ✓ Agronomists

Alerta fitosanitaria

Centro de Investigación de la Caña de Azúcar de Colombia



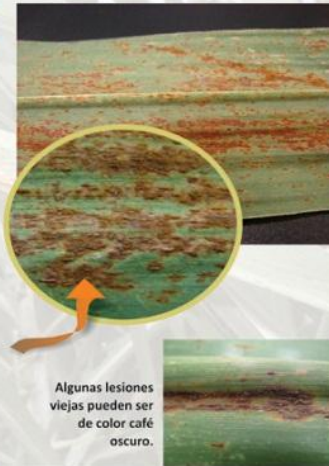
Roya naranja en el valle del río Cauca

En julio de 2010 se registraron en caña de azúcar en el valle del río Cauca, Colombia, los primeros indicios de la presencia del hongo *Puccinia kuehnii*, agente causal de la enfermedad roya naranja.

Síntomas



- Los síntomas de la presencia del hongo se observan principalmente en el envés de las hojas, donde aparecen pequeñas lesiones alargadas de color amarillo pálido.
- A medida que la infección avanza, las lesiones aumentan de tamaño y adquieren un color anaranjado que luego pasa a ser entre anaranjado y café.
- En las hojas afectadas aparecen grupos de pústulas que contienen las esporas del hongo, las cuales tienen una apariencia de polvo anaranjado y son dispersadas por el viento.



Algunas lesiones viejas pueden ser de color café oscuro.

Medidas de control

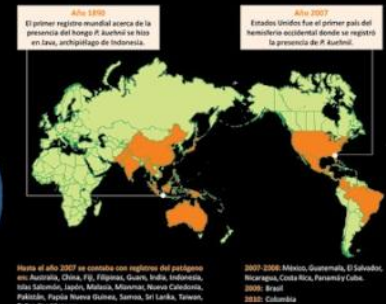
- La siembra de variedades de caña resistentes al patógeno es la principal medida de control.
- En las plantaciones afectadas por roya se recomienda aplicar fertilizantes nitrogenados y riego después de los cinco meses de edad del cultivo, lo cual estimula la producción de nuevo follaje y la recuperación de la planta.
- Evitar la multiplicación de variedades susceptibles.

En Colombia, hasta el momento el 98% del área dedicada a la producción de azúcar se encuentra sembrada con variedades resistentes.

Más información en www.cenicana.org



DISTRIBUCIÓN DE LA ENFERMEDAD



Evaluaciones del efecto de la enfermedad en la producción en variedades susceptibles señalan que en Australia se redujo el tonelaje de caña por hectárea en 38-40% en la variedad Q124, y en Guatemala la disminución fue de 7.6% en la variedad CP 72-2086.

Vigile las áreas de cultivo y si detecta indicios de la enfermedad avise de inmediato al departamento técnico de su ingenio, donde le informarán los procedimientos que debe seguir.

Concluding Remarks

- We have got orange rust.
- Commercial varieties are resistant (CC85-92 and CC84-75) .
- New promissory clones are resistant to orange rust.
- High percentage of orange rust-resistant varieties in germplasm bank.
- Extension service: Farmers continue to be trained in orange rust recognition and management.



Thank you.

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Clones trials – Piedmont zones (Stage III)

Variety	R	S
CC 01-86	5	12
CC 98-426	5	7
RB 73-2223	5	4
CC 01-399	5	2
CC 01-746	5	1
CC 04-707	5	1
CC 04-599	5	1
CC 98-997	5	1
CC 01-183	5	1
CC 85-92	0	0
CCSP 89-43	0	0
CC 84-56	0	0
CC 84-75	0	0
SP 71-6949	0	0
PR 67-1070	0	0
CC 85-92	0	0

Variety	R	S
CC 95-5992	0	0
CC 93-7711	0	0
CC 91-1590	0	0
CC 99-2461	0	0
CC 00-3079	0	0
CC 91-1606	0	0
CC 00-3867	0	0
CO 421	0	0
CC 00-3771	0	0
CC 00-3403	0	0
CC 00-3885	0	0
PR 75-2002	0	0
CC 00-3614	0	0
CC 00-3755	0	0
CC 00-3870	0	0
CC 04-627	0	0

Variety	R	S
CC 04-656	0	0
CC 04-849	0	0
CC 01-336	0	0
CC 04-667	0	0
CC 04-884	0	0
CC 98-615	0	0
CC 99-2455	0	0
CC 99-2493	0	0
CC 98-1124	0	0
CC 01-385	0	0
CC 00-3012	0	0
CC 00-3257	0	0
CC 04-656	0	0
CC 04-849	0	0
CC 01-336	0	0
CC 04-667	0	0



Commercial fields and nurseries (2011)

Comercial

Variety	R	S
CC 84-75	0	0
CC 85-92	0	0
CC 87-434	0	0
CC 93-4418	0	0

Semicomercial

Variety	R	S
CC 92-2198	0	0
CC 93-3826	0	0
CC 93-3895	0	0
CC 93-4181	0	0

Nurseries

Variety	R	S
CC 92-2804	0	0
CC 97-7170	0	0
CC 00-3079	0	0
CC 01-1228	0	0
CC 01-1940	0	0
CC 00-3614	0	0
CC 00-3771	0	0
CC 01-1484	0	0
CC 01-174	0	0
CC 01-385	0	0
CC 01-678	0	0
CC 01-746	0	0
CC 03-154	0	0
SP 71-6949	0	0
RB 72-2223	0	0
CC 91-1606	0	0

Nurseries

Variety	R	S
CC 91-1606	0	0
CC 96-6953	0	0
CC 98-577	0	0
CC 99-2282	0	0
CC 04-409	0	0
CC 05-739	0	0
CC 05-902	0	0
CC 05-906	0	0
CC 05-920	0	0
CC 05-935	0	0
CC 05-939	0	0
CC 05-940	0	0
CC 05-942	0	0
CC 05-948	0	0
CC 05-950	0	0
CC 06-780	0	0

