International Poplar Commission 23rd Session
"Poplar, willows and people's wellbeing"
Beijing, China 26-30 October 2008

Food and Agriculture Organization of the United Nations

for a world without hunger

Importance of resistance screening in willow-biomass plantations

for sustainable good performance

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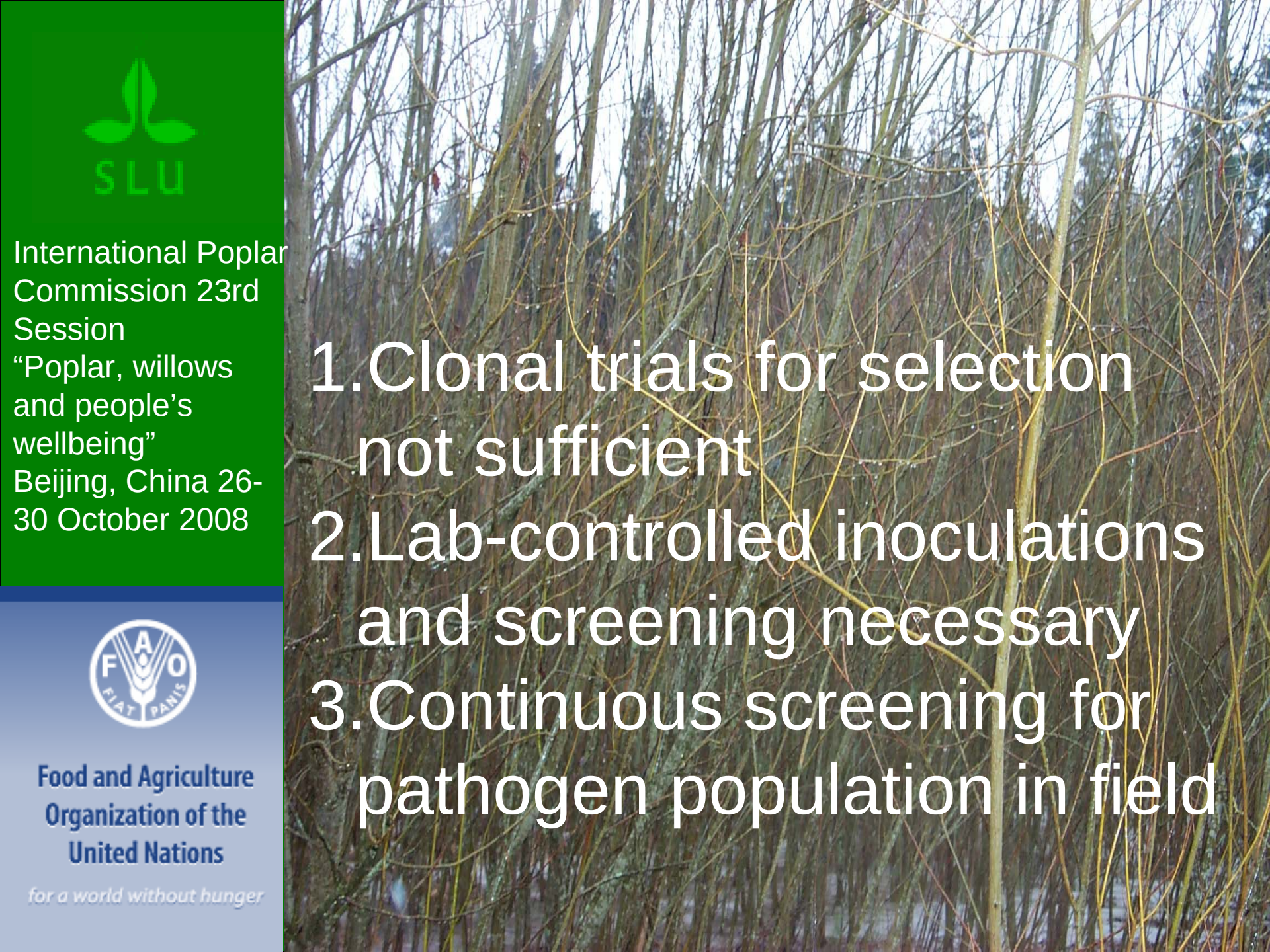
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International Poplar Commission 23rd Session
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1.Clonal trials for selection not sufficient
2.Lab-controlled inoculations and screening necessary
3.Continuous screening for pathogen population in field
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New habitat for pathogens and predators

Some invade at once

Other requires more time

Willow rust

Host multiplied by cuttings – clonal host
Ideal system for a pathogen for adaption and selection
Will appear after several years

Bacteria

Can affect the crop after several years of growth and build up of the epiphytic population

Production of new clonal material

- Selected from produced crossings
- Tested in clonal trials
- Selected for best performance in new trials

- **Problems**:
  - short time – small plantations
  - only register pathogens present in high enough quantities

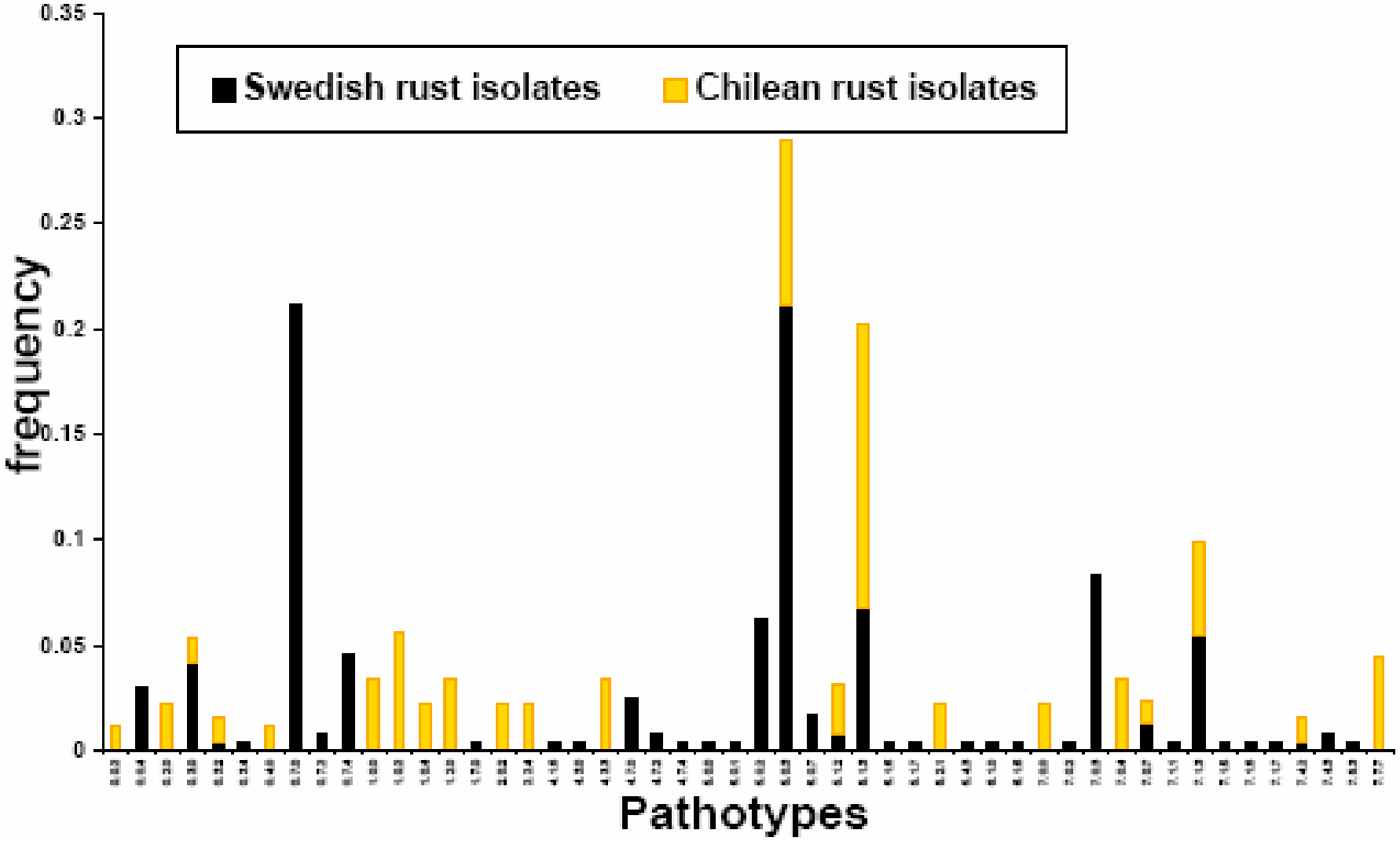
Specificity – pathotypes

The rust population consists of a variety of different types with a variation of virulence pattern on different clones

Table 2. Pathotypes found in Sweden 1991-96

f. sp.	Pathotype No.	Pathotype code	TESTCLONES 1 Mull	2 Q83	3 Stip	4 B. H.	5 -149	6 Calod	7 Korso	8 Him.	9 -139
	1	0.0.0									
LD	2	0.0.4									+
	3	0.3.0						+	+		
	4	0.3.2					+	+	+		
	5	0.3.4						+	+		+
	6	0.7.0						+	+	+	
	7	0.7.2					+	+	+	+	
LR	8	0.7.4						+	+	+	+
	9	1.7.0	+					+	+	+	
	10	4.1.6			+		+	+			+
	11	4.3.0			+			+	+		
	12	4.7.0			+			+	+	+	
	13	4.7.2			+		+	+	+	+	
	14	4.7.4			+			+	+	+	+
	15	5.0.0	+		+						
	16	5.0.1	+		+	+					
	17	5.0.2	+		+		+				
	18	5.0.3	+		+	+	+				
	19	5.0.7	+		+	+	+				+
	20	5.1.2	+		+		+	+			
	21	5.1.3	+		+	+	+	+			
	22	5.1.6	+		+		+	+			+
	23	5.1.7	+		+	+	+	+			+
	24	5.4.3	+		+		+			+	
	25	6.1.0		+	+			+			
LET	26	6.1.6		+	+		+	+			+
	27	7.0.2	+	+	+		+				
	28	7.0.3	+	+	+	+	+				
	29	7.0.7	+	+	+	+	+				+
	30	7.1.1	+	+	+	+		+			
	31	7.1.3	+	+	+	+	+	+			
	32	7.1.5	+	+	+	+		+			+
	33	7.1.6	+	+	+		+	+			+
	34	7.1.7	+	+	+	+	+	+			+
	35	7.4.2	+	+	+		+			+	
	36	7.4.3	+	+	+	+	+			+	
	37	7.5.3	+	+	+	+	+	+		+	
virulence factor			1	2	3	7	8	4	5	6	9

Frequency of the different pathotypes in Sweden and Chile



Genetic diversity – variation of the pathogen

- Within-plantation variation of the rust virulence is higher than between plantations
- High similarity of rust between different geographic regions → rust spreads easily over long distances
- Mapping of 89 rust isolates from Sweden, UK / Northern Ireland, France, and Chile show no clustering according to geographical origins of isolates → Same population in all countries
- Pathotype composition differ

Breeding material

Willows from:

Russia, far east, Poland, Germany and UK

Rust from??

Asia, North- and South America, Europe

Willowclones used in Sweden regarded as resistant could be attacked by rust in Russia.

Poplarclones with good performance in Europe will get heavily attacked by rust in China

Need of continuous recording of pathogens present

Summary – rust problems

- Rust produce a high amount of spores, many cycles each season. Fast selection – new varieties of the pathogen.
- Earlier resistant clones usually attacked by rust in a few years
- Genetic mapping ⟶ common global population
- Intercontinental inocula can significantly affect local pathotype structures depending on clones planted
- Distant rust varieties must be regarded in willow resistance breeding
- New immigration of compatible pathotypes is possible every season

Clones appearing resistant maybe only meet the pahtogen in very low amounts

Bacterial diseases

- Specific Poplar problem, e.g. *Xanthomonas populi*

- Willows – no similar symptoms noticed, weak and atypic necrosis – frost?
- Sampling in Sweden – bacterial infections!

Bacterial diseases

- No problem in the field (*observed*)
- ”Breeding for frost hardiness will do it”
- New better clones replacing old ones
- Reports of sudden diebacks in ”healthy” commersial plantations
- Worst in plantations with high production

General assessments and collections of endo- and epiphytically growing bacteria

- 14-20 clones of Willows
- Several sites in Sweden and Estonia
- Symptoms of presence found in most plantations
- Approx 300 bacterial isolates first test
- *Erwinia spp., Pseudomonas syringae, Sphingomonas / P. fluorescens* and *Xanthomonas spp*
- Epiphytic colonisation – large variation among clones.

“Bad News”

- Commonly appearing bacteria in nature
- NOT specific willow pathogens
- Same bacterial populations also on healthy plants

CONCLUSIONS

- Clonal trials with field observations will not show correct resistance performance
- Lab tests for known aggressive strains of pathogens necessary
- Fungi and bacteria adapt to new conditions – selection for new varieties low in present population
- Continuous screening will alarm for new varieties building up – time for crop change


Screen for healthy willows and poplars
Thank You!
Supported by STEM and EU-QoL
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