Cactoblastis cactorum
Fiend and Foe

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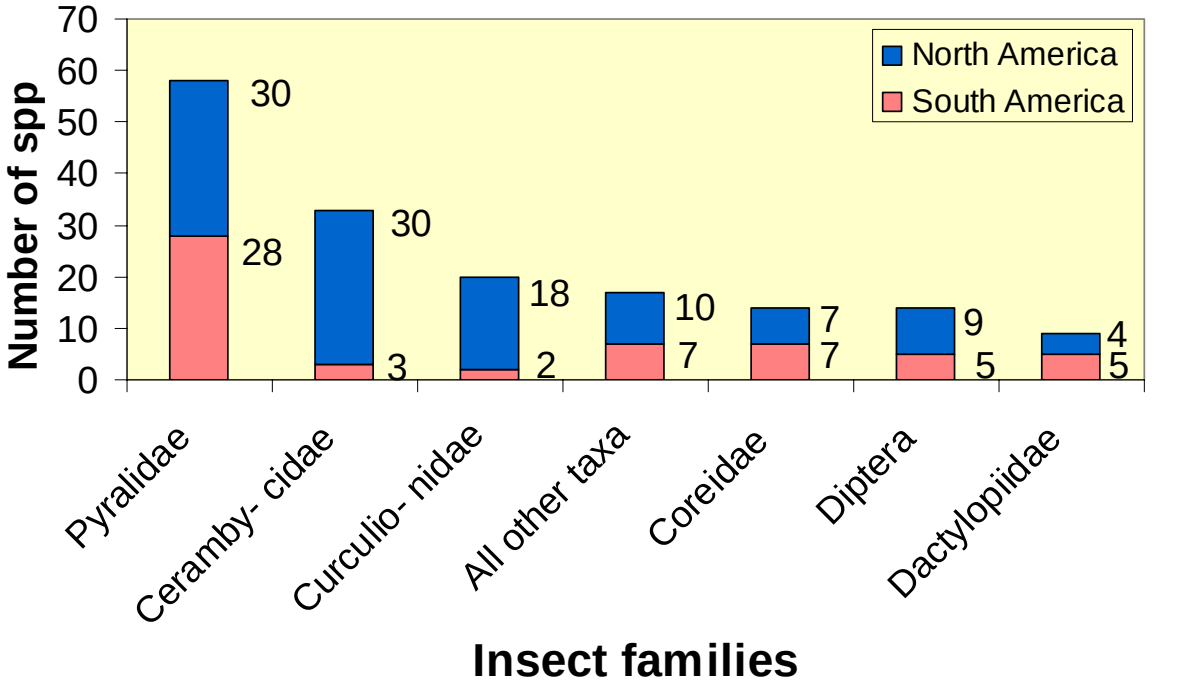
60 spp in fam. *Pyralidae* (*Phycitinae*) specific to *Cactaceae*, mainly in the genus *Opuntia*



4 recognized species in the genus *Cactoblastis*, possibly 2 undescribed.
All except *C. cactorum* are host specific.
All but 1 (undescribed sp.) specific to genus *Opuntia*.

C. bucyrus	Andean provinces, Argentina
C. mundelli	Peru
C. doddi	Andes, Argentina
~~*C. ronnai*??~~	~~Argentina~~
C. cactorum (5 biotypes)	Argentina
Cactoblastis sp F	Argentina

The life stages of *C. cactorum*

Countries outside Americas invaded by introduced cacti, mainly *Opuntiae*: Australia, South Africa, Ethiopia, India, Mauritius, Madagascar.

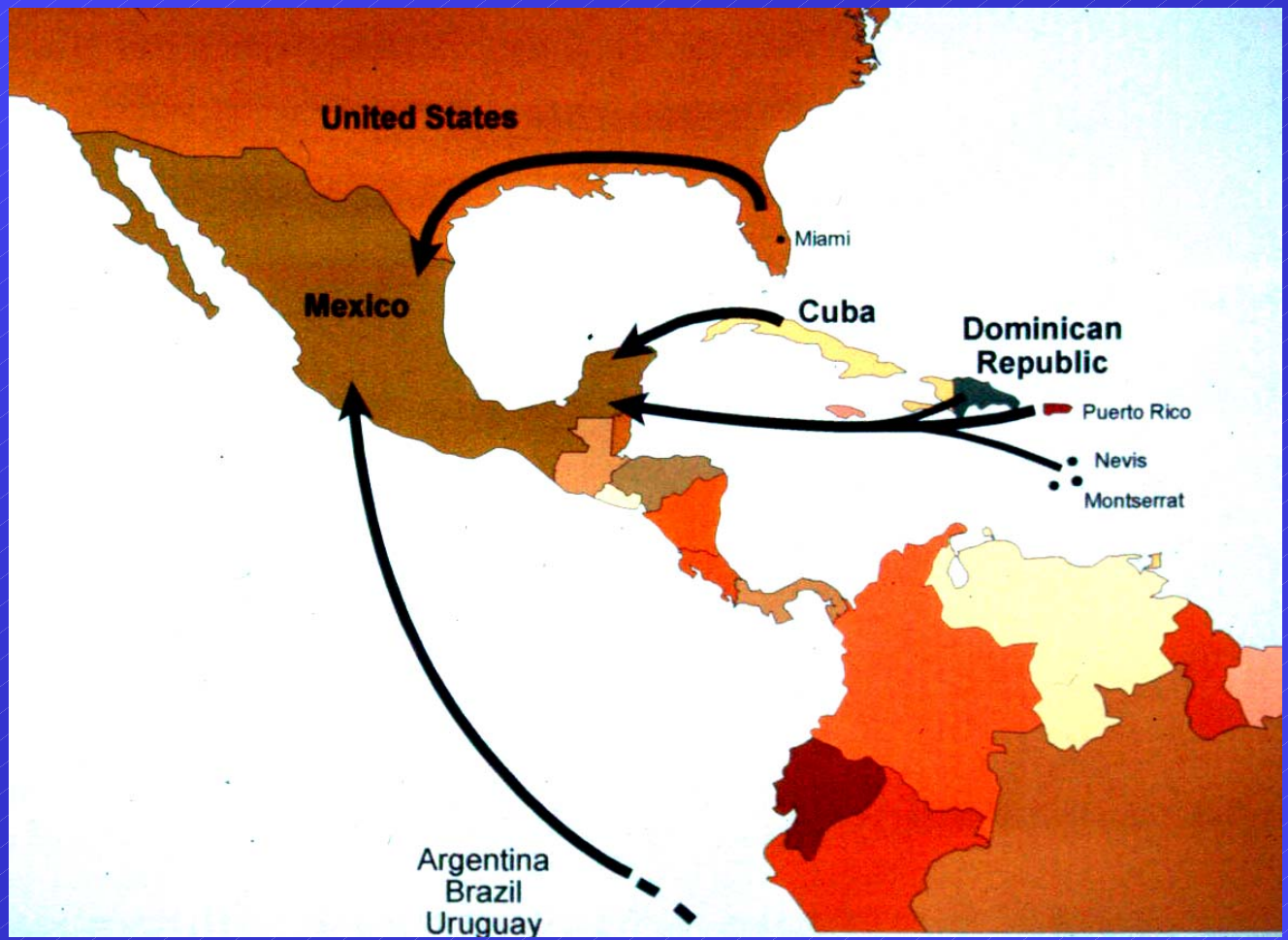
Conventional control methods not sufficient to reduce or even contain invasive populations.

Cactoblastis first introduced to Australia in 1926 - then many other countries - exceptionally good biological control of mainly the smaller species.

Queensland & NSW: memorial hall in honour of *Cactoblastis*

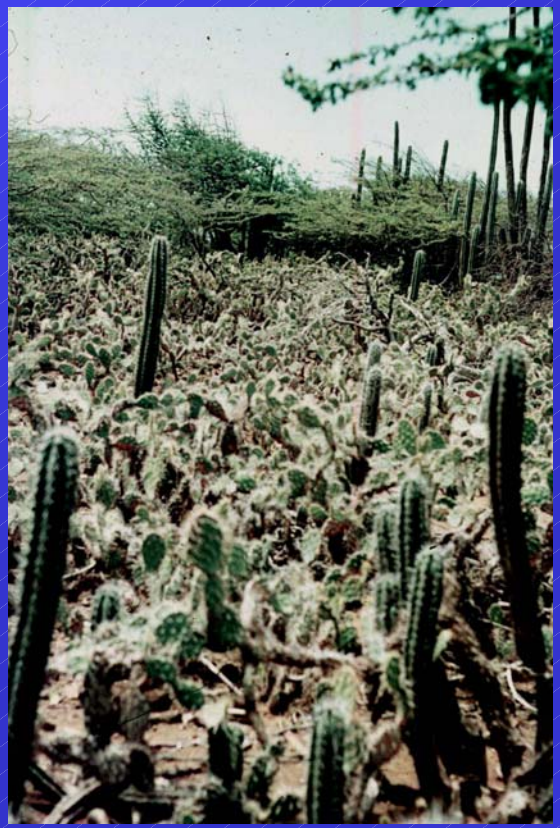
Still countries with serious invasions
e.g. Ethiopia, Eritrea
- no other option than biological control

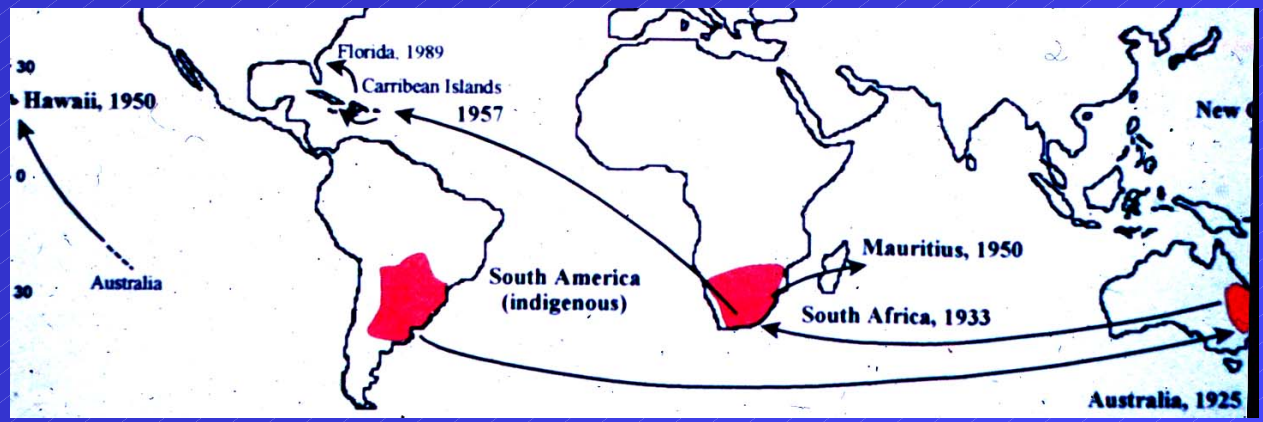
Cactoblastis also controlled **native** *Opuntia* spp - island-hopped to many other Caribbean countries, carried by man(?)
Arrived in Florida in 1987^{+} through nursery trade (?)



Question: when will it arrive in Mexico – and what then?

Densification of **native** *Opuntia* spp.
as result of overgrazing -
serious invasions -
introduction of *Cactoblastis*.
MISTAKE!





Key Question 1:

Actual and Potential Host Range

Field observations:

- Few *Opuntia* spp. resistant to insect.
- Larger ‘woody’ spp.less likely to be killed.
- Low-growing spp. extremely vulnerable.

Threat to North America:

Most: Small or young plants of woody spp.

Least: *Opuntia* cultivations.

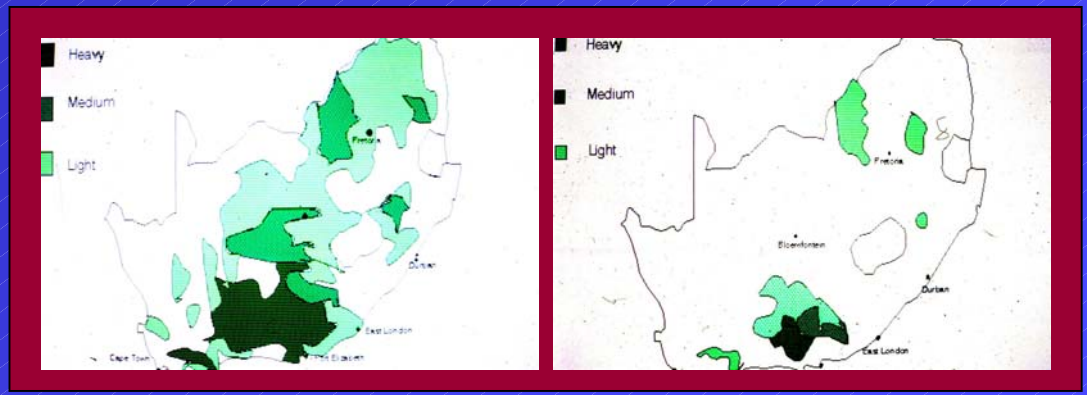
Known hosts of *Cactoblastis cactorum* outside its native range

New associations	Old associations
Opuntioideae - Platyopuntiae	
Opuntia ficus-indica XX	*Opuntia aurantiaca XXX*
Opuntia compressa XXX	*Opuntia monacantha XXX*
Opuntia engelmannii X	*Opuntia salmiana XX*
Opuntia spinulifera X	*Opuntia glomerata*
Opuntia streptacantha XX	*(Tephrocactus glomerata)*
Opuntia stricta XXX	*Opuntia bonaerensis XXX*
Opuntia tomentosa x	
Opuntia microdasys x?	
Opuntia repens XXX	
Opuntia tuna XXX	
Opuntia elatior XXX	

Known hosts of *Cactoblastis cactorum* outside its native range

New associations	Old associations
Cylindropuntiae	
Opuntia imbricata x	
Opuntia tunicata ?	
Opuntia leptocaulis	
Cactoidea	
Echinopsis spachiana	*Cereus peruvianus*
	Eriocereus martinii
	Eriocereus tortuosa
Pereskioideae	
Pereskia aculeata	*Maihuenia* sp.

C. cactorum gave good/ excellent control of many invasive *Opuntia* spp from South and North American origin - low host-specificity within the genus *Opuntia.*



Cactoblastis cactorum as a successful biological control agent

Opuntia stricta (*inermis, dillenii*)	Highly successful.
O. aurantiaca	Contributes substatially to control.
O. ficus-indica	Limited success - highly effective in controlling small plants.
O. engelmannii (*lindheimeri*)	Good control in pastures.
O. streptacantha	Causes damage only.
O. tomentosa	Poor oviposition, limited attack. No control.
O. triacantha	Effective control.
O. tuna	Effective control.
O. vulgaris	Good control to considerable damage.
Opuntia sp. (Ascencion Island)	Good control.

Key Question 2

Dispersal: Apparent and real

FACTS ON DISPERSAL

- Vestigial mouthparts - reluctant and low flyer - erratic and jerky flight pattern;
- Low dispersal rate at high host plant densities;
- Observations:
  - A moth flew 24 km to oviposit (Australia)
  - 16-24 km dispersal within 2.5 years (Australia)
  - 3-6 km in 2.5 years (South Africa)
  - 256 km per year in Florida, decreasing to 40 km (576 km from 1989-1991)
  - Failed to disperse 50 km to large food source in 15 yrs.

Explanation for inter-island hopping in WI:

- Deliberate and unauthorized introductions.
- Deliberate and planned introductions.
- Inadvertent introductions through plant trade.
- Natural dispersal of adult.

Key Question 3:

Observed

and

Potential Mortalities

MORTALITIES (South Africa)

(Parasitism, predation, diseases, mucilage, unknown, climate)
Based on 2 hosts: *Opuntia ficus-indica & O. aurantiaca*

- Larval mortalities: 54-40% (summer); 41-64% (winter).
- Summer: natural enemies more important; winter: climate.
- Pupal mortalities: 56-65% (summer); 53-51% (winter).
- Life table: adult mortalities 45% (summer); 84% (winter).
- 1st instar larvae prevented from entering cladodes by mucilage exudations.

Key Question 4:

Can

Cactoblastis cactorum

be controlled

EXISTING CONTROL METHODS

- CONVENTIONAL CONTROL
- BIOLOGICAL CONTROL
- INNOVATIVE CONTROL
- PREVENTION

CONVENTIONAL CONTROL

- COMMERCIAL PLANTATIONS
  - Good control possible
  - Scout for egg sticks during 2 well-defined oviposition stages p/a - remove infected cladodes.

- WILD POPULATIONS
  - Conventional control difficult : extent of area involved, inaccessibility and searching difficulties.

BIOLOGICAL CONTROL

Opportunities limited:

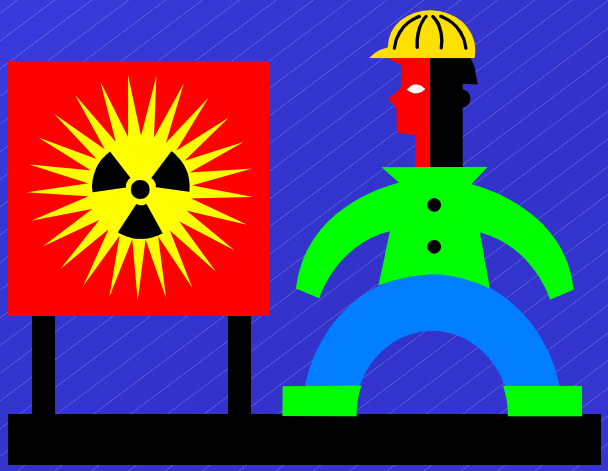
lack of host-specificity;
less effective at low population densities;
will not prevent further dispersal.

Might be more effective in commercial plantations using inundative method.

INNOVATIVE CONTROL

Trapping using sex pheromones:

- effective control
- stop further spread.

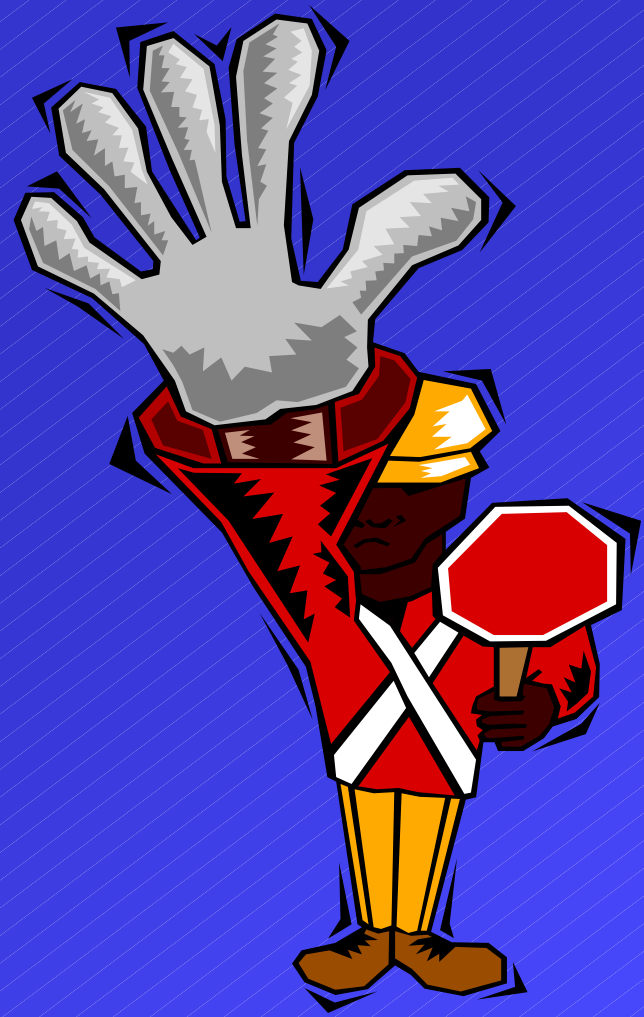


Inherited (F1) sterility :

- controlling insect along the leading edge.

PREVENTION

The best method by far is keeping *Cactoblastis cactorum* out of uninfested areas, countries or states.



CONCLUSIONS

- Assume that threat is real.
- Key questions: host selection, dispersal behaviour, expected impact.
- Modern control techniques: contain populations, reduce spread.
- Cost-benefit analyses will show if biocontrol is an option.
- Mexico has human resources & international cooperation to draft effective strategy.

I thank the IAEA for support in attending this meeting