

Cactoblastis cactorum in South Africa

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Background

→ Primarily introduced ex Australia 1932 for the BC of *Opuntia ficus-indica*. Results were not according to expectations;



Background (cont.)

➔ Risks were much debated before a third introduction was eventually approved for release.



Background (Cont.)

→ Ineffective in controlling mature *O. ficus-indica* plants but effective in destroying young plants and preventing regrowth.



Background (Cont.)

→ Highly valued for its effect on other *Opuntia* invaders, mainly smaller species e.g. *O. aurantiaca*, *O. stricta*, *O. humifusa*, *O. salmiana* etc.

Background (Cont.)

→ Pest status on commercial plantings are problematic but generally accepted. Control of *Cactoblastis* is not difficult.



We learned to live with the cactus moth....



Present status

The overall cost-benefit ratio for biological control of all invasive opuntia species is estimated to be in the region of 700:1 (for Australia 361:1)

- Cactoblastis is indispensable

Life Table Studies in South Africa

Robertson & Hoffmann (1989) Bull. Ent. Res. 79:7-17

- This study was done near Grahamstown (33°12' S, 26°22'E) with a moderate climate
- Field mortalities of all stages of *C. cactorum* will vary considerably within the distribution range in South Africa.

Mortality factors on *O. ficus-indica* 1. eggs (summer and winter)

- Egg predation: 57%-53%
 - Breakage and disappearance: 24%- 10%
 - Parasitism: 0.04% - 0.1%
 - Unhatched 1.0% - 4%
- TOTAL: 82% - 67%



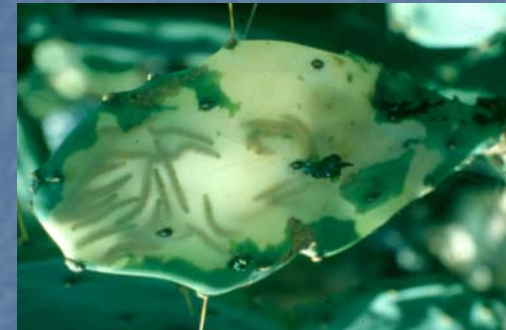
Mortality factors on *O. ficus-indica* 1. larvae (summer and winter)

Pre-penetration

- No penetration (colonies) 0.4% - 5.4%
(impenetrable cuticle, gum, extreme temperatures)
- During penetration (colonies) 16.3% - 13.8%
(predation, extreme temperatures, unknown)

Post-penetration

- Dispersal (leaving cladode) 5.1% - 2.2%
- Unknown factors* (colonies) 12.2% - 11.8%
- Unknown factors* (individuals) 22.3% - 18.8%
- * including food shortage, disease, predation, parasitism
- TOTAL 39.6% - 32.8%



Mortality factors on *O. ficus-indica* 3. pupae (summer and winter)

- Parasitism and predation 40% - 18.3%
(mainly ants, diseases and occasional parasitism)
- Disappeared 10.3% - 10.5%
- Unknown (undamaged) 2.9% - 6.8%
(incl. temperature extremes)

TOTAL



54.3% - 39.8%

Mortality factors on *O. ficus-indica* 4. adults (summer and winter)

Calculated from the total mortality figures
in the life-table

Overall mortality 45.3% - 84.0%

(low temperatures, emergence, mating, oviposition)



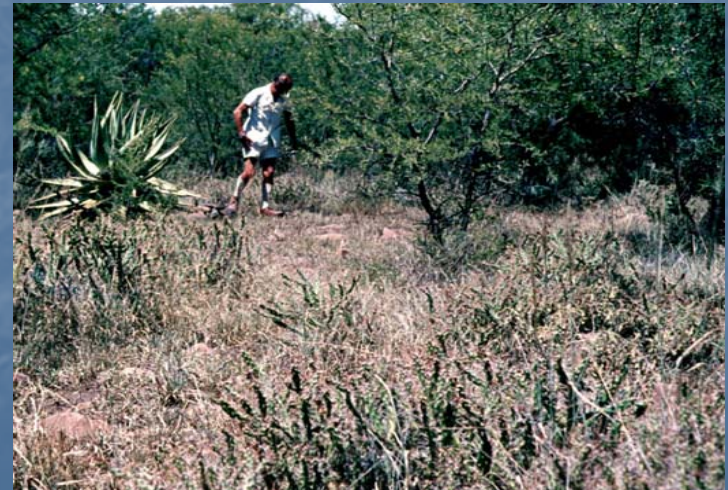
Mortality factors by hosts:

O. ficus-indica vs. *O. aurantiaca*

- Survival of all life stages were higher on *O. ficus-indica* than on *O. aurantiaca*



O. ficus-indica



O. aurantiaca

Conclusion on life-table studies

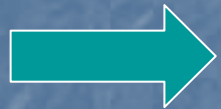
1. Egg predation, low temperatures and host plant resistance were the key mortality factors.
2. Parasitism by parasitoids was of little importance.

Some potential hosts of *Cactoblastis cactorum* in South Africa

- *Opuntia* spp. naturalized a) Mexico/USA 25 (11 weeds)
b) S. America 13 (5 weeds)



Host acceptance within the Opuntioideae



Cactoblastis shows clear host-plant preferences within the 38 naturalized species:

- Anecdotal
- Experimental

Multi-choice oviposition trials



Ovipositional preferences within six *Opuntia* species in multiple choice tests

Opuntia host	No. egg sticks	Total no. eggs
Ficus-indica	39	1701
Engelmannii	8	379
Stricta	10	453
Leucotricha	0	-
Fulgida*	0	-
Imbricata*	20	934

* chollas

Host performances under controlled conditions (60 eggs/host X 6 replicates)

Opuntia host	% pupation	no. pupae	Duration of development
Ficus-indica	79	95	35
Engelmannii	57	69	45
Stricta	55	66	61
Leucotricha	29	35	60
Fulgida*	24	29	56
Imbricata*	16	20	49

*chollas

Degree of host susceptibility

Highly



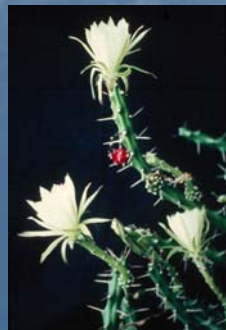
Moderate



Low



Resistant



Climatic tolerances (larvae)

- Cactoblastis is found throughout South Africa but populations vary.
- Rare temperature extremes are recognized mortality factors.
- Larvae are often seen leaving cladodes at both high ($> 40^{\circ}\text{C}$) and low (-6°C dry) ambient temperatures.
- Freezing appears to be fatal but are rare events.



Control of *C. cactorum*

Intensive control of *Cactoblastis* is confined mainly to highly productive fruit orchards.

1. Orchard sanitation
2. Deltamethrin contact insecticide during egg-stage phases: Oct/Nov and Feb/Mar. Chemical control is primarily aimed at cochineal.



Control of Cactoblastis (Cont.)

- In less productive plantations e.g. fodder insecticides are seldom applied and control relies more on utilization and sanitation.



Conclusions and recommendations

- 1: Adding cactoblastis to the existing long list of native pests in Mexico and the USA may be hard on producers;
- 2: Amongst native species we can expect a scale of susceptibility;
- 3: Native parasitoids from cactophagous Pyralids from North America may become a regulating limiting factor. Maybe we should also NOT ignore the potential of classical biocontrol;
- 4: The value of life-table studies should not be underestimated when designing prediction models and when deciding on control strategies;

Conclusions and recommendations

(Continued)

- 5: Climate is not likely to be a strong limiting factor for establishment below the 35° latitude, but the degree of aggression will vary depending on local conditions and extremes;
- 6: There is no clear evidence of any permanent adaptive diversification within the cactoblastis population in South Africa;
- 7: From a South African perspective it is a worthwhile investment to prevent the westward spread of cactoblastis towards the cactus-rich areas of the USA and Mexico.

Thank you!