Mite Genotype vs. Fern Genotype

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Biological Control of *Lygodium microphyllum* Old World climbing fern

- Native to Old World wet tropics (Australia, Africa, Asia, Oceania)
- Introduced into Florida as ornamental plant in the 1890's
- Became serious weed in the 1990's
- Biological control program started 1999

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Rapidly spreading across tree islands of the Everglades

Native habitats

Lygodium - NOT Weedy
Does not dominant landscape
In a matrix with other plants

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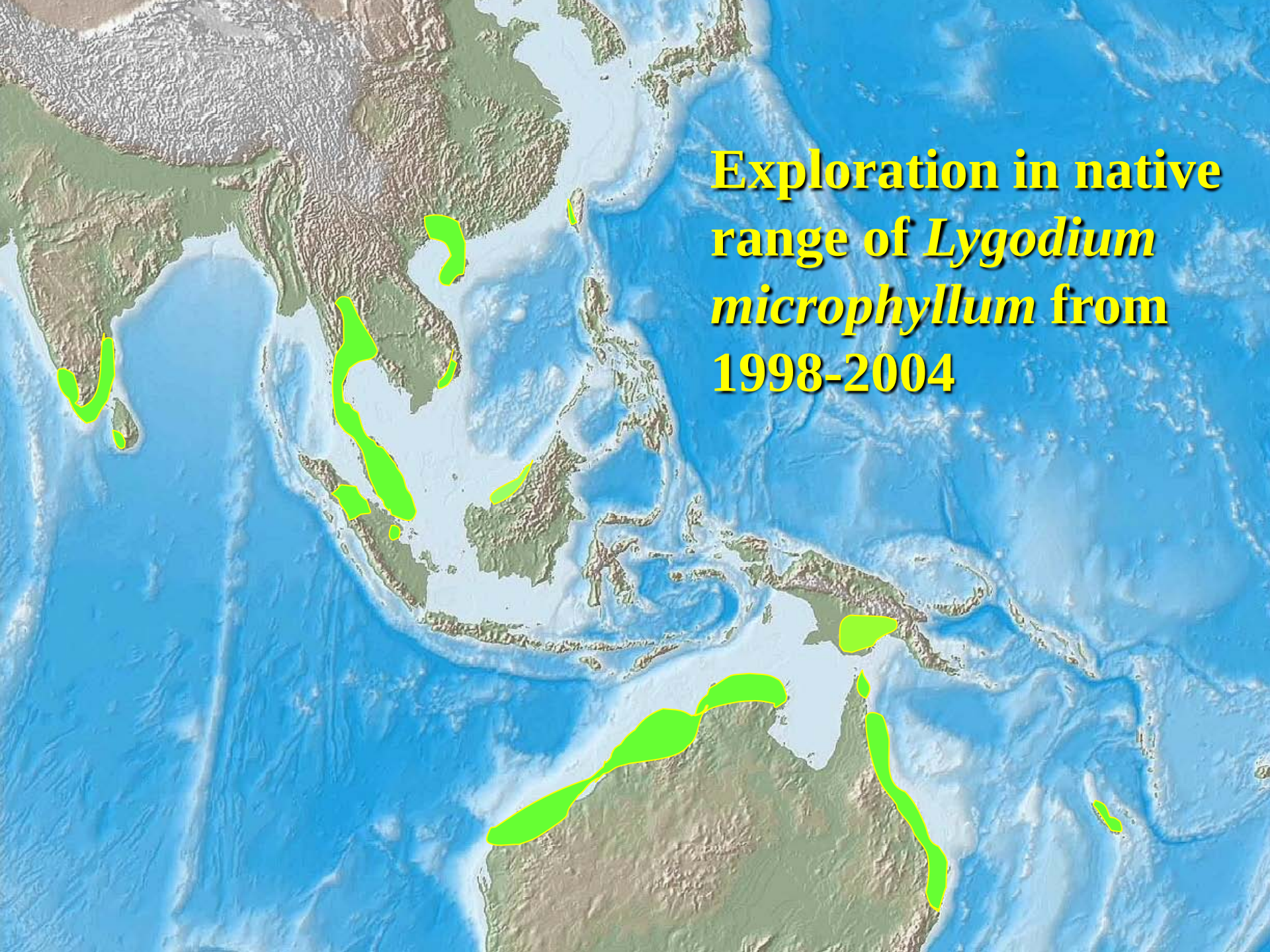
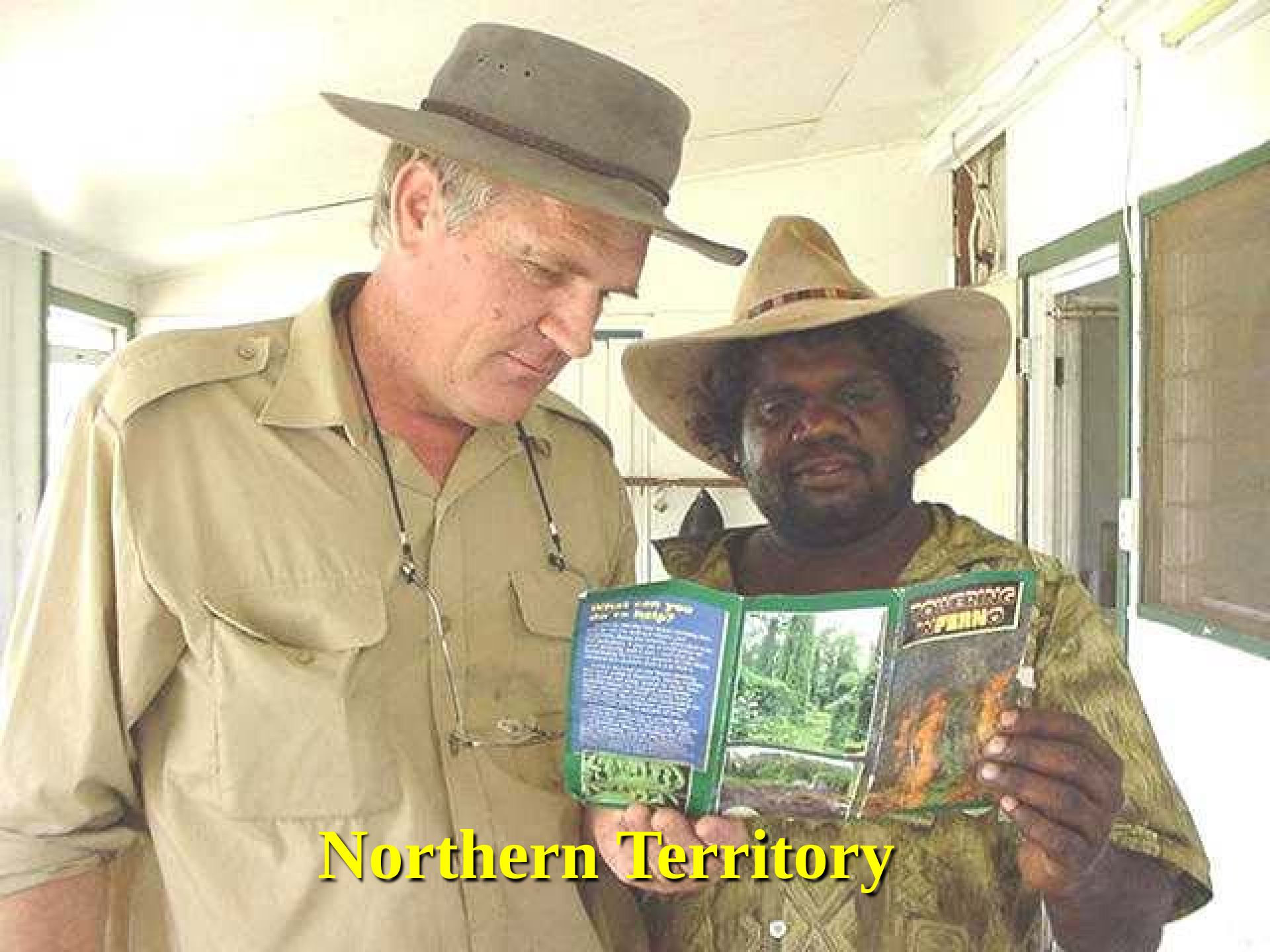

Exploration in native range of *Lygodium microphyllum* from 1998-2004


Eubanangee Swamp, QLD


Northern Territory


Bungle Bungles, WA

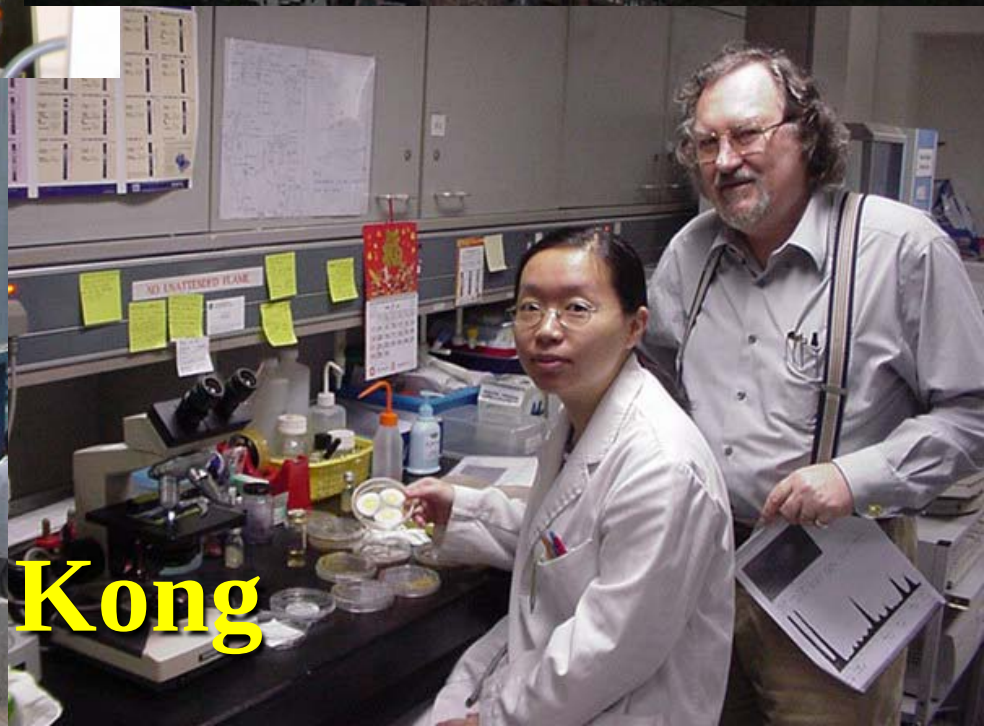

New Caledonia


Carbrook Creek, Logan, QLD


Thailand

Purses made from Lygodium - Thailand


香港城市大學
City University of Hong Kong
chExpo
Multi-Purpose Rooms
Amenities Building



Hong Kong

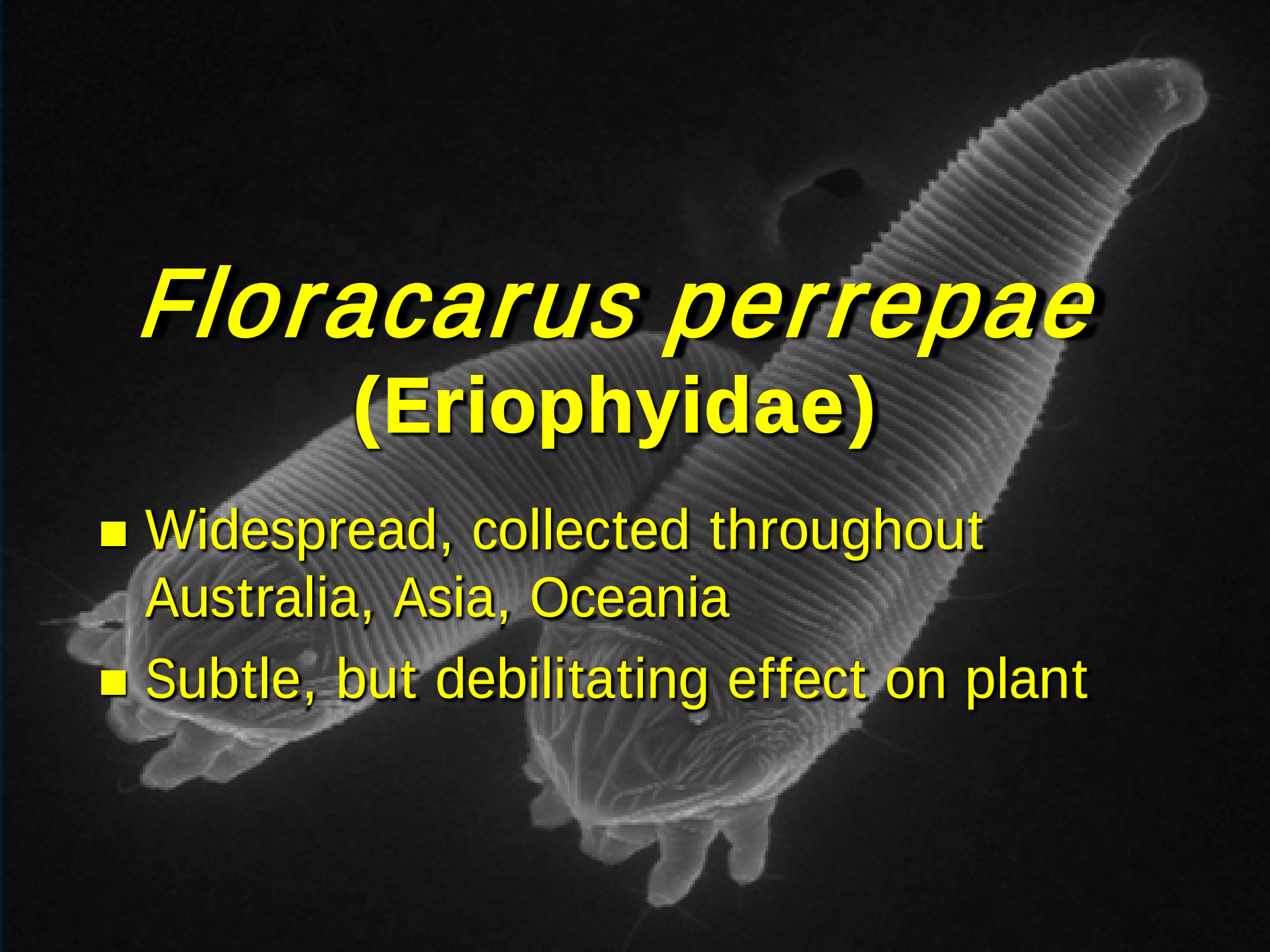

India, Tamil Nadu


ZOOLOGY


Papua New Guinea

22 *Lygodium* Herbivores

Eriophyid mite



Floracarus perrepae (Eriophyidae)

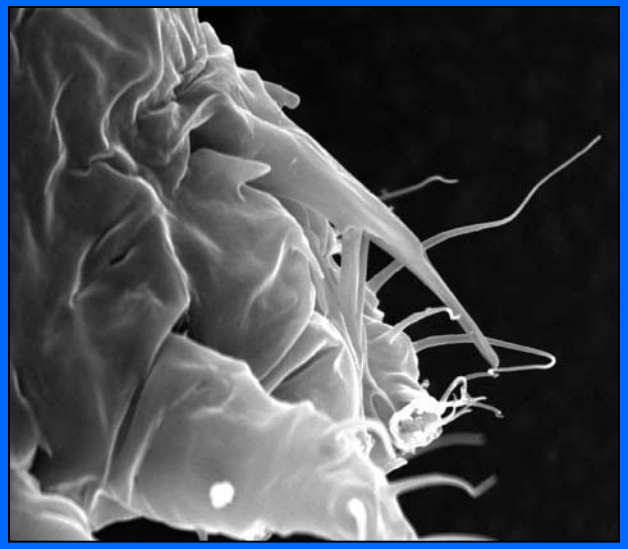
- Widespread, collected throughout Australia, Asia, Oceania
- Subtle, but debilitating effect on plant

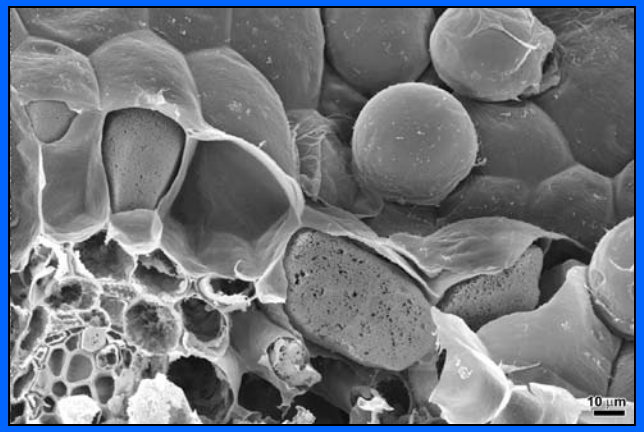
Mite Damage

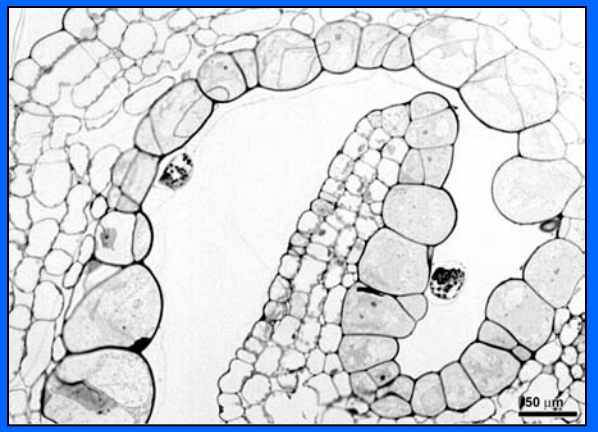

Adult mite feeds
on leaf margin

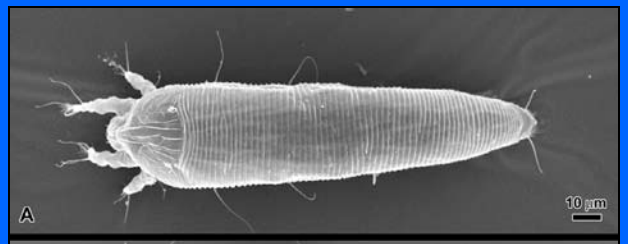

Mite induces
leaf rolling

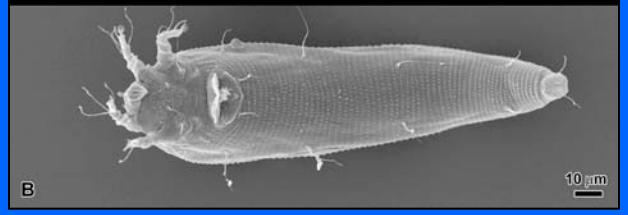

Feeding leads to
leaf necrosis

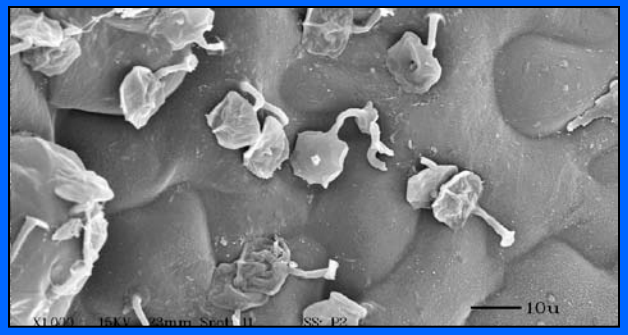












Biology

- Egg, larva, 2 nymphal instars, adult
- 16 day life cycle at 22º C
- 60 eggs per female

- Mite feeding stimulates development of large nutritive cells - curls
- Induction of leaf rolling limits host range

Predictive Studies

- Can we use studies in native range to estimate impact of *Floracarus perrepae?*
- No dramatic successes yet from eriophyids

(Briese & Cullen, 2001)

Chemical Exclusion Studies

- Field plot block design
- Biomass production with and without mite
- Agrimec® to control mite
- Harvested 4 pairs each quarter
- 2 year study

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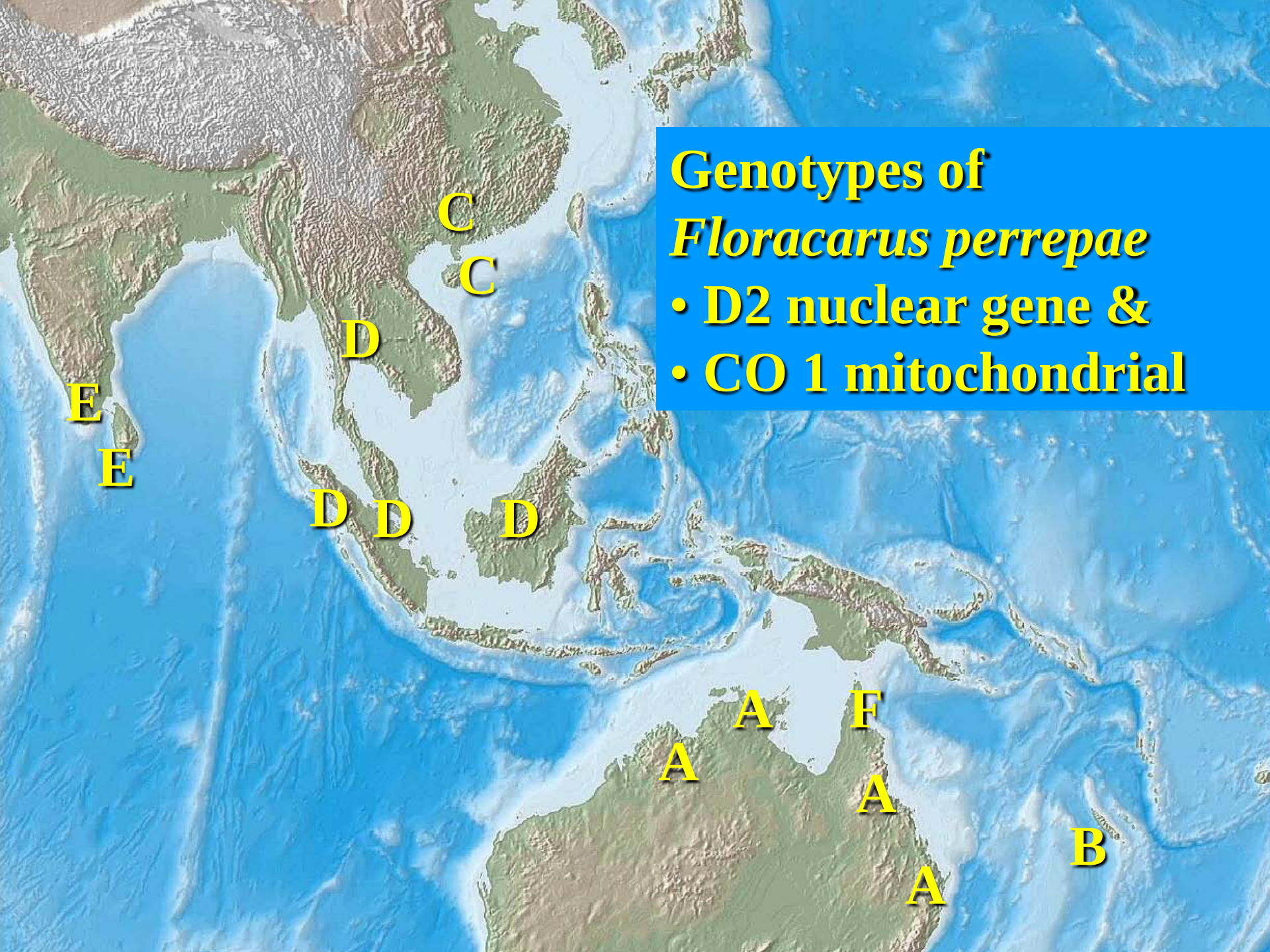
Impact Studies

- Greater than 50% reduction in biomass over 2 year period

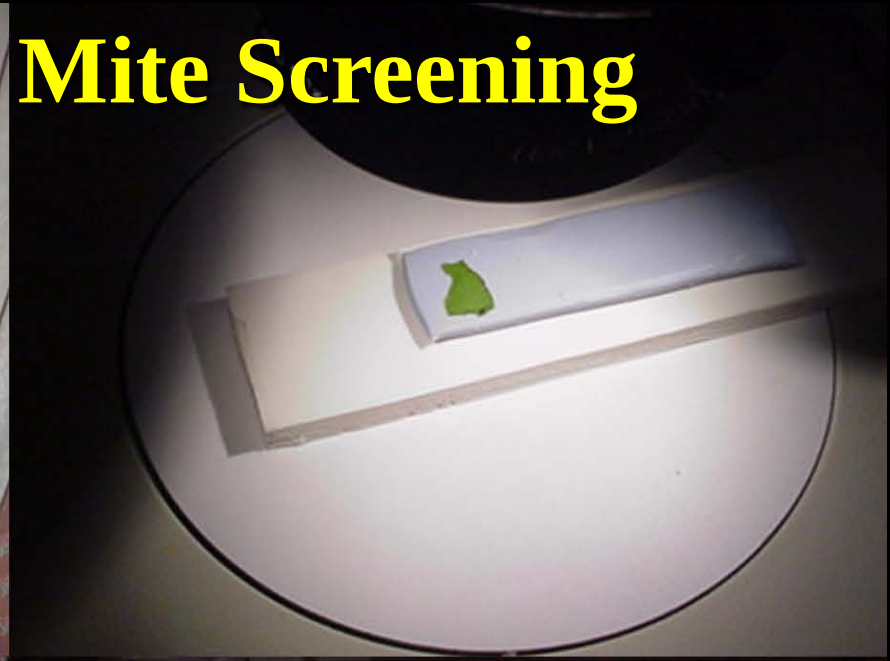
- Florida *L. microphyllum* not acceptable to local Queensland mite

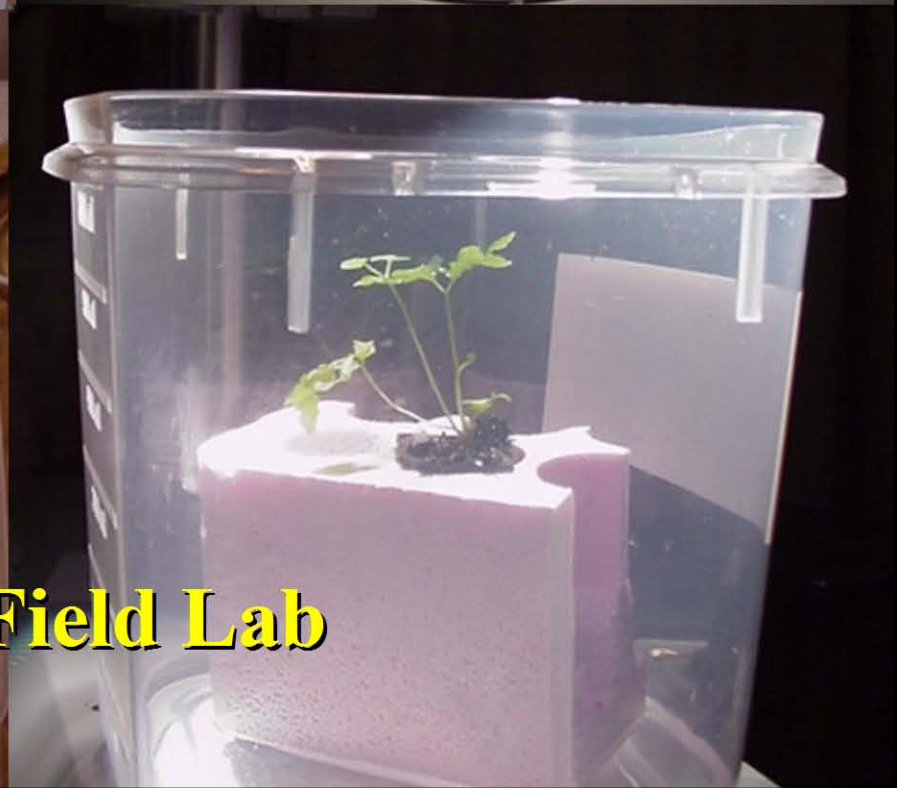
Discovery of Mite Genotypes

- Characterization of *F. perrepae* from throughout its distribution revealed several distinct genotypes
- Nuclear D2 and mitochondrial CO1 genes
- Developed mobile field lab to screen genetic diversity for acceptability of Florida fern genotype


Genotypes of
Floracarus perrepae
• D2 nuclear gene &
• CO 1 mitochondrial
C
C
D
E
E
D
D
D
A
F
A
A
B
A

In Country Mite Screening





Mobile Field Lab

Mite Genotype	Queensland Fern	Florida Fern
Cape York - F	*	***
Thailand - D	-	**
India - E	-	**
New Cal - B	**	*
China – C	**	-
Australia – A	***	-

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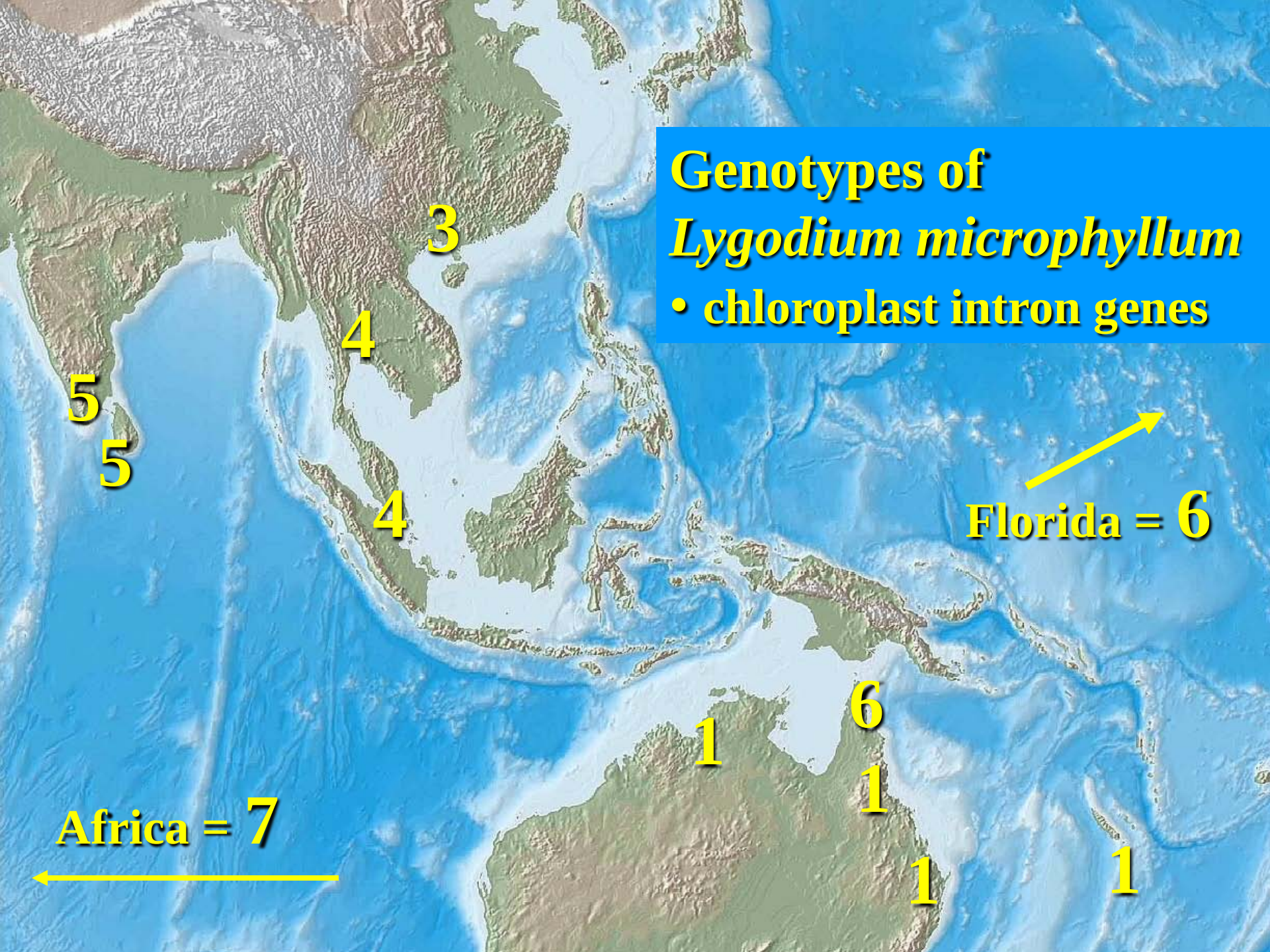
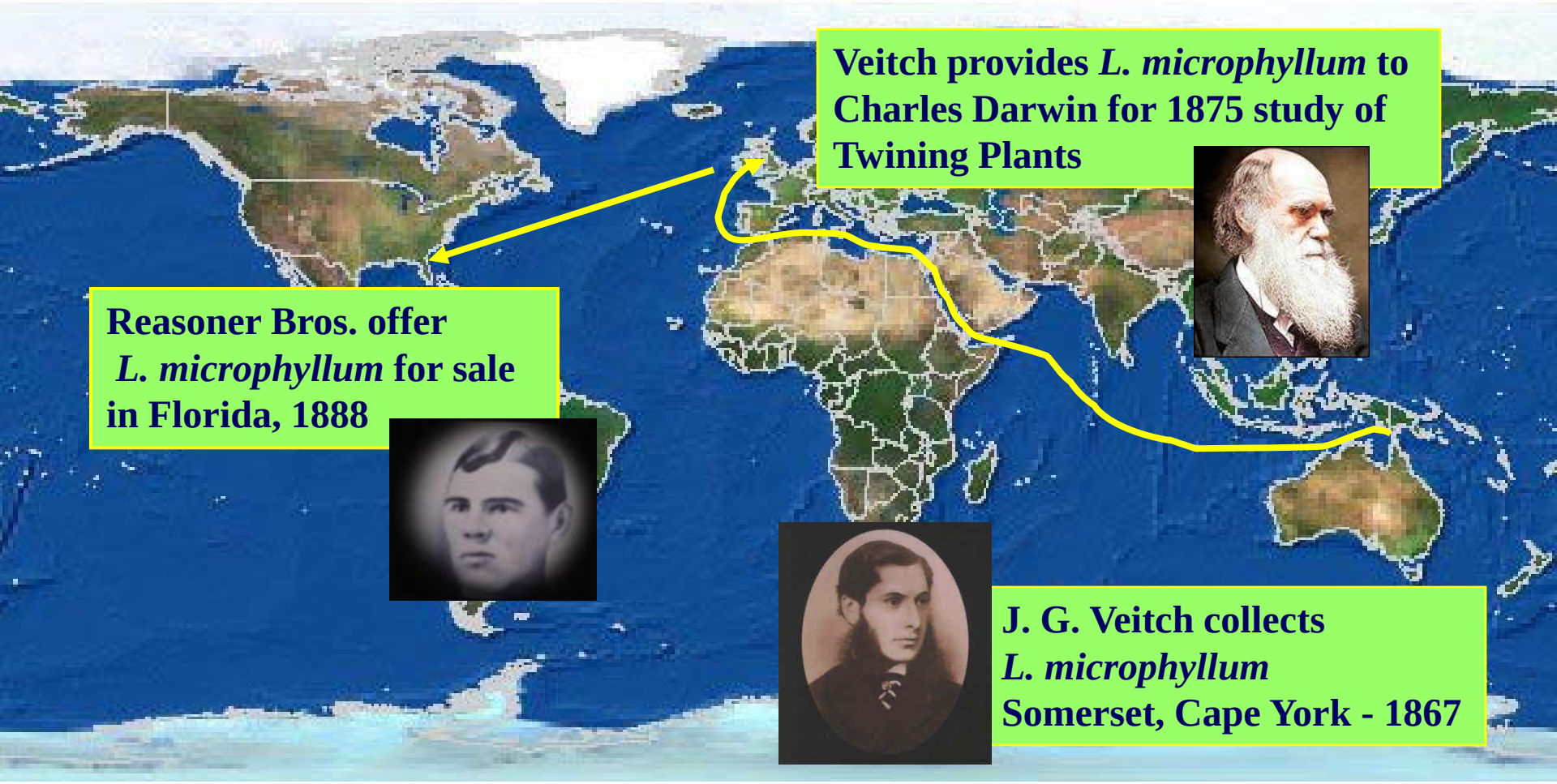
What is *Lygodium microphyllum?*

- **Chloroplast introns trnL (550 base pairs) and rps4-trnS (690 base pairs) used to characterize genotypes and match Florida population with origin.**


Genotypes of
Lygodium microphyllum
• chloroplast intron genes
3
4
5
5
4
Florida = 6
6
1
1
1
1
Africa = 7

Source of Invasive *Lygodium microphyllum*?



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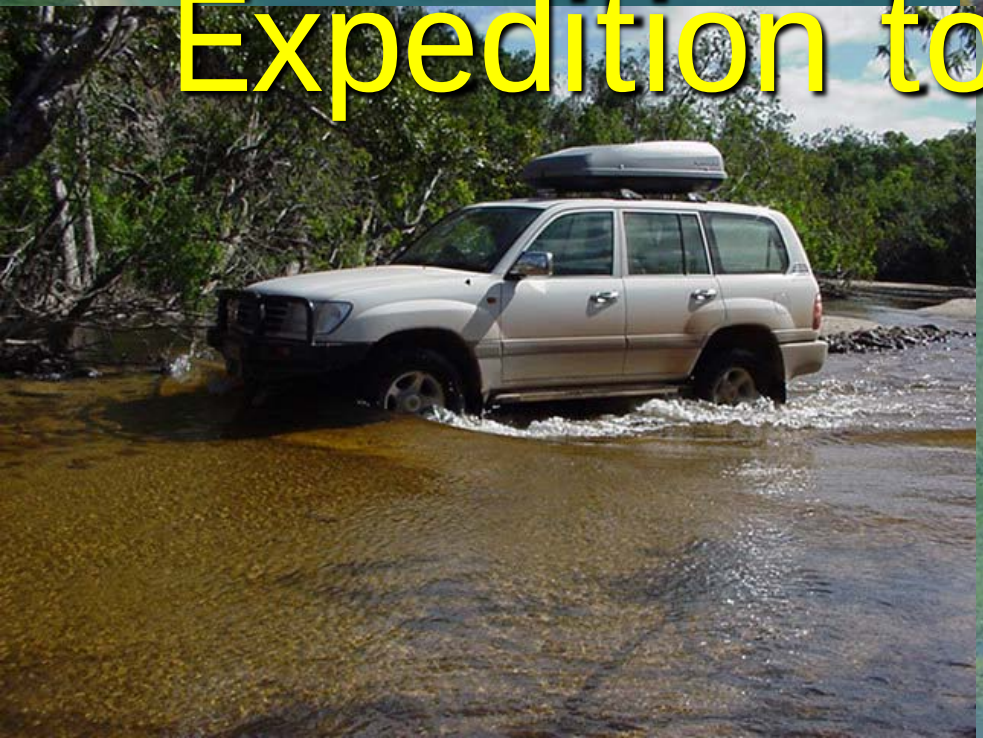
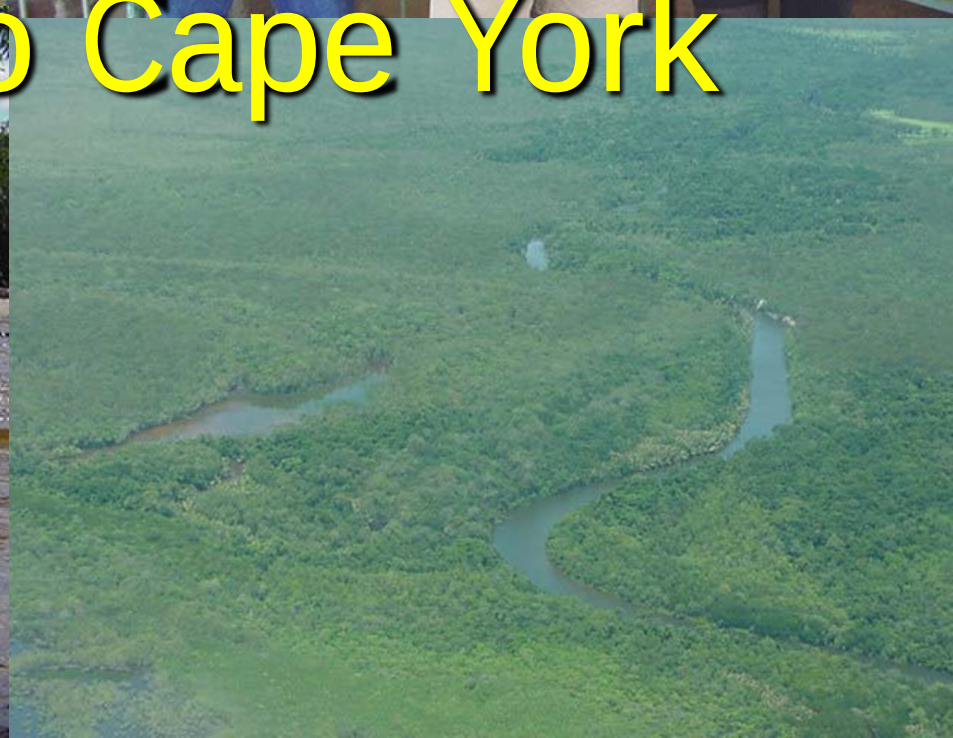
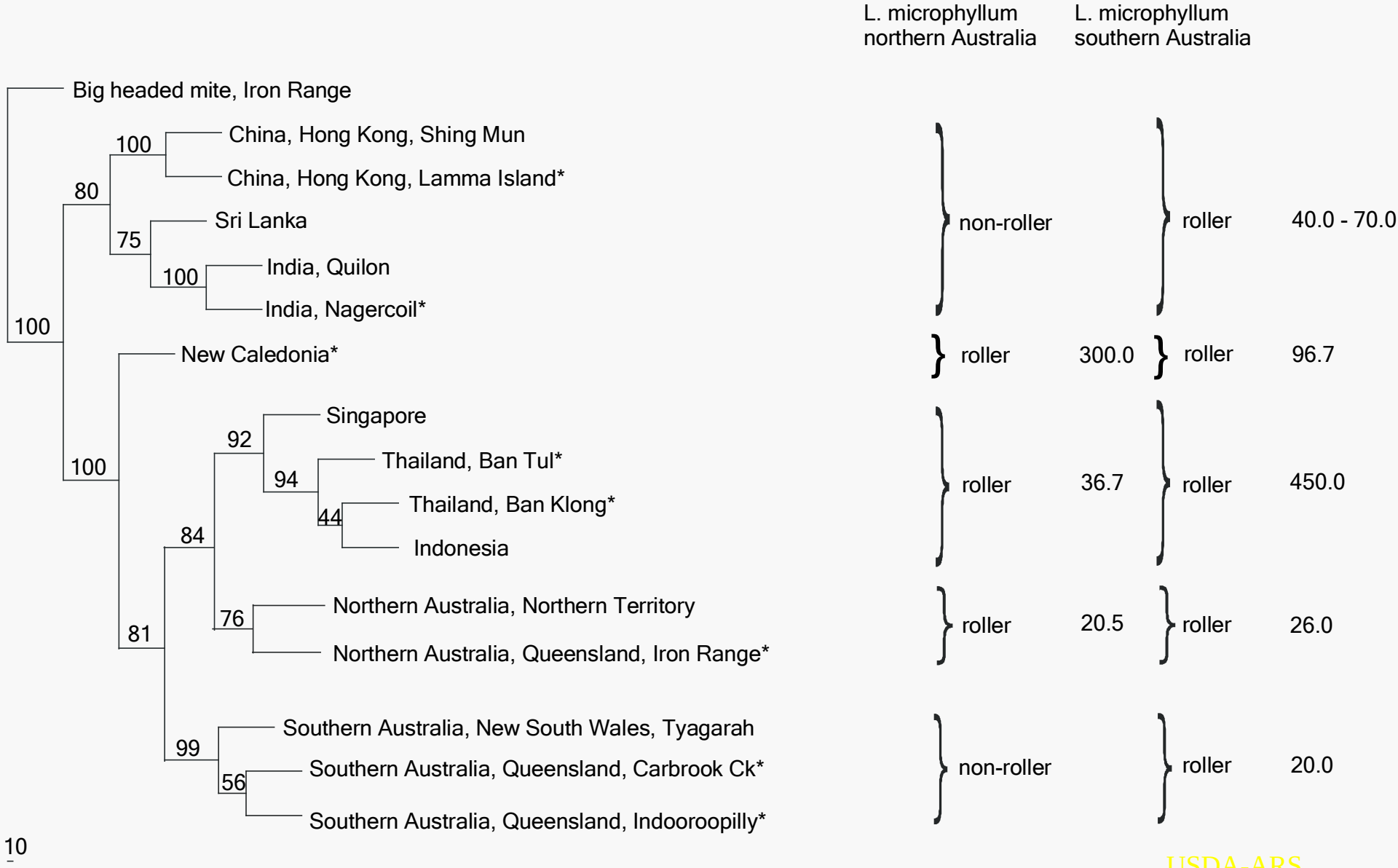
Expedition to Cape York

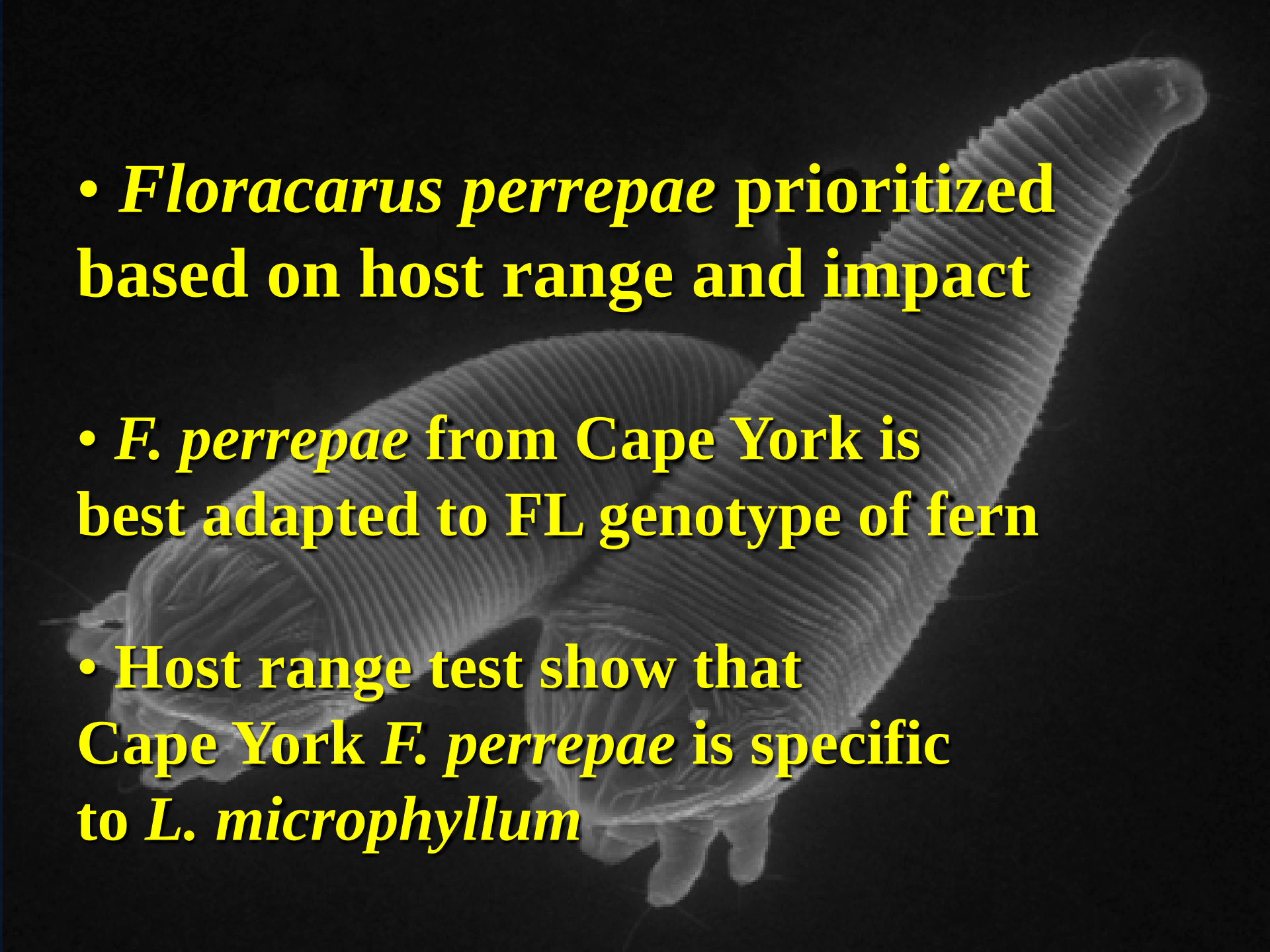




Knowing the origin of the *Lygodium* really matters

- Origin leads us to the most co-evolved *Floracarus perrepae* genotype.


L. microphyllum
northern Australia
L. microphyllum
southern Australia
Big headed mite, Iron Range
China, Hong Kong, Shing Mun
China, Hong Kong, Lamma Island*
Sri Lanka
India, Quilon
India, Nagercoil*
New Caledonia*
Singapore
Thailand, Ban Tul*
Thailand, Ban Klong*
Indonesia
Northern Australia, Northern Territory
Northern Australia, Queensland, Iron Range*
Southern Australia, New South Wales, Tyagarah
Southern Australia, Queensland, Carbrook Ck*
Southern Australia, Queensland, Indooroopilly*
100
80
100
75
100
100
92
94
44
84
76
81
99
56
non-roller
roller
roller
roller
roller
non-roller
roller
40.0 - 70.0
300.0
96.7
36.7
450.0
20.5
26.0
20.0
10



- ***Floracarus perrepae*** **prioritized based on host range and impact**

- ***F. perrepae*** **from Cape York is best adapted to FL genotype of fern**

- **Host range test show that Cape York *F. perrepae* is specific to *L. microphyllum***

Conclusion

- ***Floracarus perrepae*** **mite established in Florida**
- **Other *Lygodium microphyllum* genotypes may be limiting its success**
- **Lygodium moth, *Neomusotima conspurcatalis* doing very well**

Acknowledgements

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THANK YOU