



Salix reinii PN688

Characterisation and Evaluation of Floral Biology in Willows

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www.treesforbeesnz.org

NZ Poplar Willow Trust Board Meeting
November 20, 2014
Palmerston North

Trees for Bees Program started 2009 Fed_Farm_ BIG www.treesforbeesnz.org



THE FUTURE OF FARMING IS
RELIANT ON ALL FARMERS
PLAYING THEIR PART IN
PROTECTING THE HONEY BEE.

WHY ARE HONEY BEES IMPORTANT?

FOR YOUR REGIONAL PLANT GUIDE

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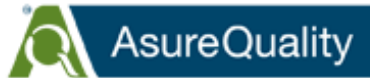
*Trees
For
Bees*





Sustainable Farming Fund

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*John Hartnell, Barry Foster,
John McLean, Paul Badger*

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The Problem of Nutrition for Bees

Removal of floral resources →

- bees malnourished -- susceptible to diseases
- long term impacts varroa mite -- exposure to viruses
- low bee populations -- colony collapses

Loss of apiary sites →

- expense and side effects of substitute feed
- expense and labour to move bees to other sites

Solution to Nutrition for Bees

Find high performance floral resources

- protein rich pollen
- abundant nectar

Plant bee nutrition sources near apiaries

- on farms, council, public and private land
- USA – Obama memo all departments
- EU – subsidised plantings on farms

June 20, 2014 from President Obama

Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

Section 1. Establishing the Pollinator Health Task Force.

There is hereby established the Pollinator Health Task Force (Task Force), to be co-chaired by the Secretary of Agriculture and the Administrator of the Environmental Protection Agency. In addition to the Co-Chairs, the Task Force shall also include the heads, or their designated representatives, from the:

- (a) Department of State
- (b) Department of Defense
- (c) Department of the Interior
- (d) Department of Housing and Urban Development
- (e) Department of Transportation
- (f) Department of Energy
- (g) Department of Education
- (h) Council on Environmental Quality
- (i) Domestic Policy Council
- (j) General Services Administration
- (k) National Science Foundation
- (l) National Security Council Staff
- (m) Office of Management and Budget
- (n) Office of Science and Technology Policy
- (o) And executive departments, agencies, and offices as the Co-Chairs may designate.

The value of willows for bees

- source of nectar and pollen in same catkins
- most abundant pollen during spring build-up



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Willows are **THE backbone of bee colony build up in spring**

Abundant trees/shrubs throughout NZ
Attractive pollen and nectar for bees
Large pollen loads easily collected

Salix reinii PN688

Photo: Manon Gabarret © Landcare Research

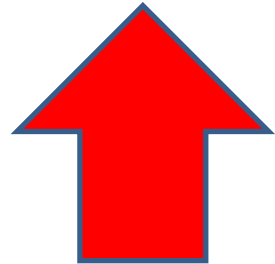


Goals for Evaluation of Willows

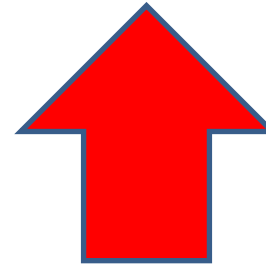
1. Extend the flowering season
 - succession of species
 - long flowering species
2. Find highest performing nutrition sources
 - quantity of pollen
 - quality of pollen (protein)
 - efficiency of pollen collection

Extend Flowering for Bees

Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Spring Build up			Clover & Kiwifruit Pollination		Summer Honey Flow		Autumn preparation for winter			Over-wintering		



Pollen
dearth



Pollen
and
nectar
dearth

Protein in Pollen from Somerville

Radiata pine (*Pinus radiata*)

Protein 9 % (v. Poor)

Sydney blue gum (*Eucalyptus saligna*)

Protein 28% (excellent)

Crack willow (*Salix fragilis*)

Protein 15% (poor)

Pussy willow (*Salix discolor*)

Protein 27% (excellent)

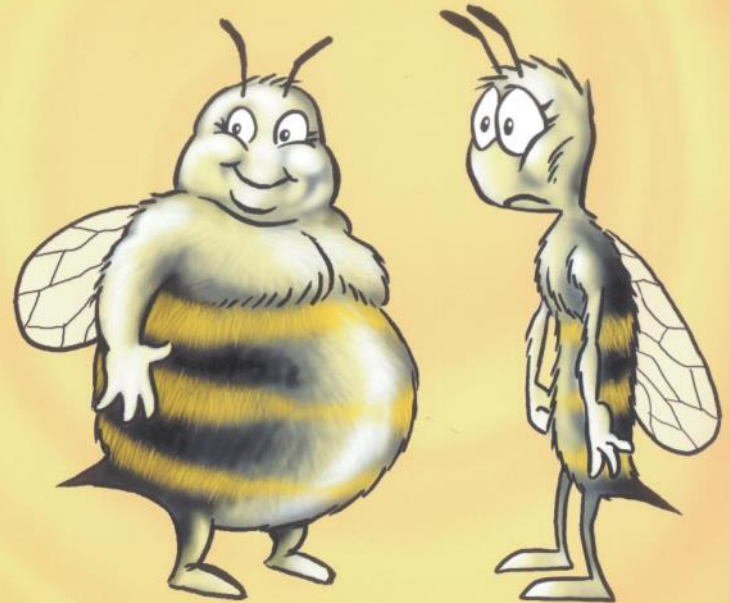


Australian Government

Rural Industries Research and
Development Corporation

FAT BEES SKINNY BEES

A manual on honey bee nutrition
for beekeepers



A Report for the Rural Industries
Research and Development
Corporation

RIRDC Publication Number 05/054
RIRDC Project Number DAN-186A

by Doug Somerville

Characterisation and Evaluation Goals

Pollen Quality and Quantity

- abundance of pollen per catkin
- density catkins per tree/shrub
- protein rich pollen

Flowering Behaviour

- duration of male and female plants
- flowering start and stop times

Two Student Interns from France

Manon Gabarret and Blandine Polturat arrived August 26th



Conal, Manon and Blandine



Conal Richardson of Rural Services Technology Nursery helped with logistics

Phenology of Flowers and Leaves



Photography



Catkin Density and Branch Diameter



Quadrat for Catkin Density



Linear Measure Catkin Density



Herbarium Reference Collection X 3



Collecting Pollen Samples in Jars



Collecting Pollen Samples in Vases



Bringing Pollen Samples To Lab



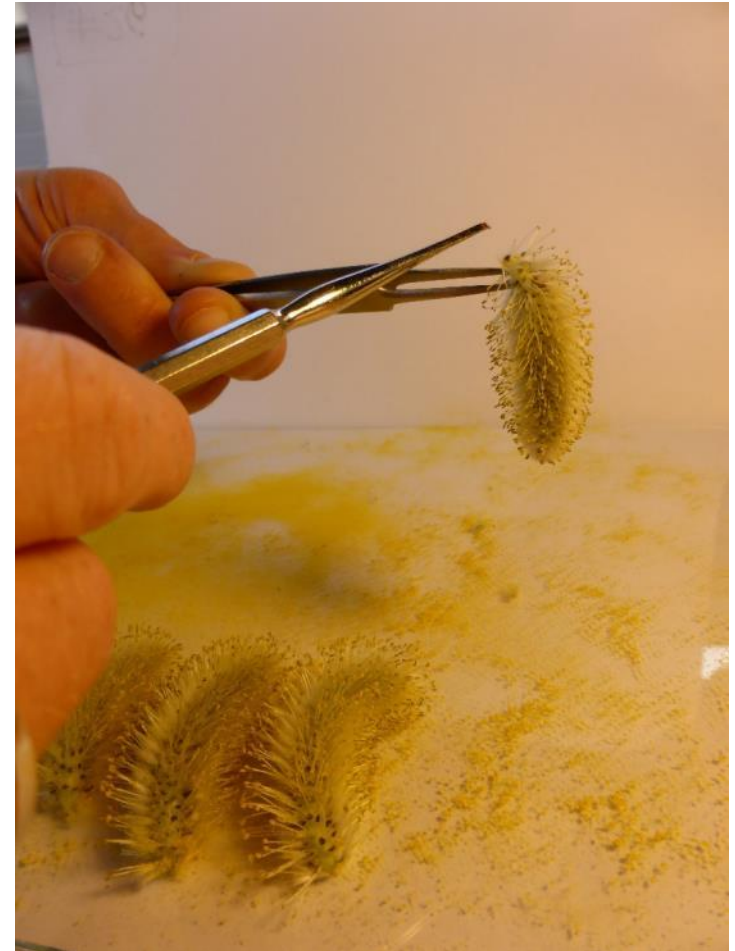
Protecting Pollen in Lab (wind, bees)



Pollen Extraction for Protein



Drying and Tapping Out Pollen



Purification of Pollen



Purification Stage 1



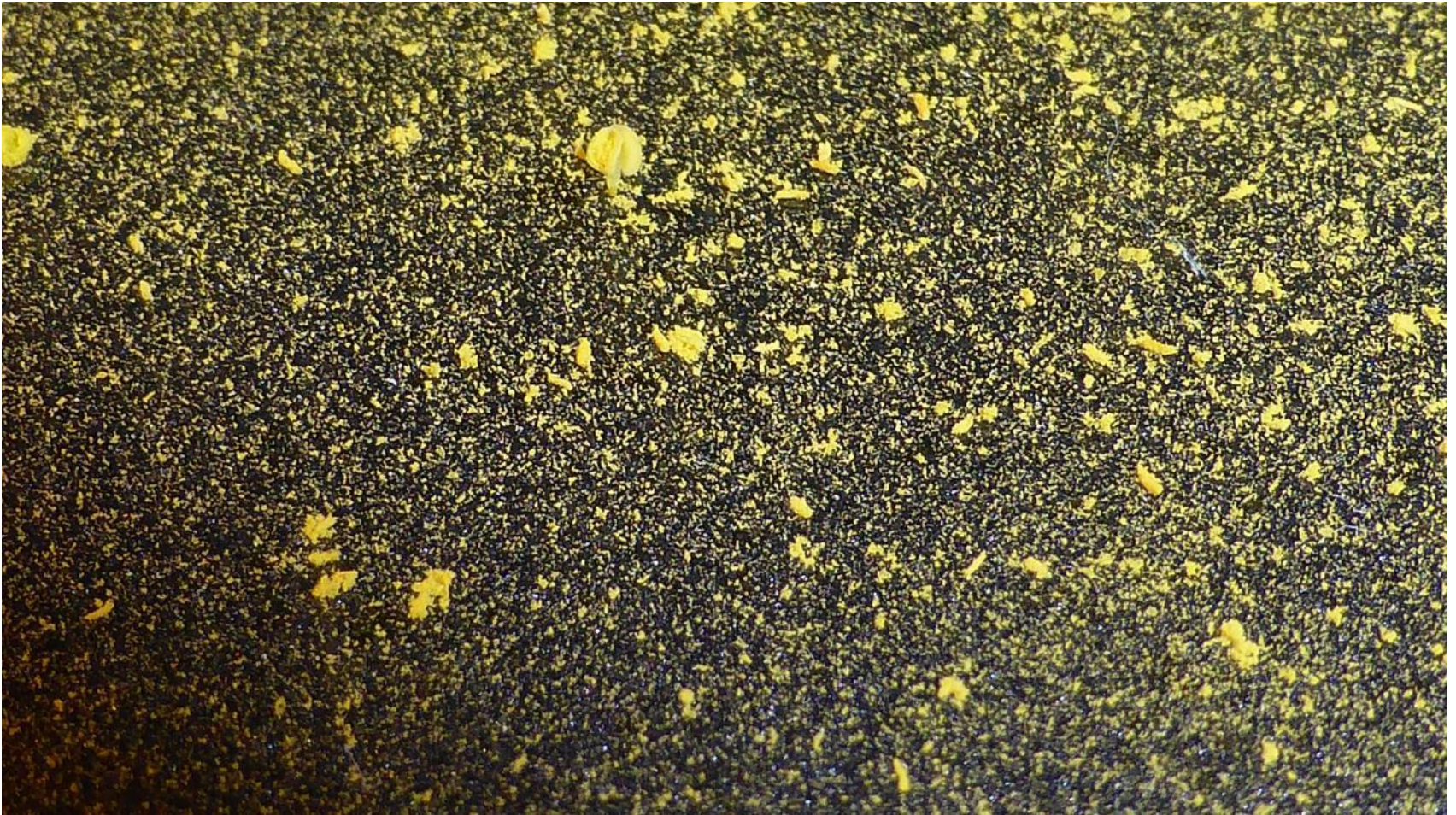
Removing Plant and Insect Parts



Purification Step 2



Removing Anthers from Sample



Vial of Purified Pollen for Protein



Summary of Data collected

In field

- phenology (flowering time)
- photos of tree, branch, catkin flowering stages
- branch diameter and catkin density
- catkin density in quadrat and linear
- herbarium specimens X 3

In Lab

- extract of pollen for protein analysis
- catkin size (length, width, shape = surface area)
- frozen flowers for anther/floret density later
- vial of catkin in alcohol to count pollen later

S. aegyptiaca first willow to flower



***S. eriocephala* is longest flowering species**



***S. triandra* is one of the last to flower**



Younger catkins

Older catkin elongated

Progressive
Pollen
Production



***S. hookeriana* 'Furry Ness' has largest catkins**



Photos: Manon Gabarret © Landcare Research

But anthers are not densely packed



S. hookeriana 'Furry Ness' PN685

Pussy Willows: largest catkins more dense anthers



S. caprea group has more dense anthers on the catkins so more pollen



For example: *S. caprea* derivatives such as *caprea* X *cinerea* = *S. x reichardtii*

***Salix x reichardtii* (Muscina) PN 714**



***S. alba* (I 8 59A) PN361**

had highest density catkins of alba clones

**Total pollen/tree
is a function of:**

1. Branch/tree
2. Catkin/branch
3. Florets/catkin
4. Anthers/floret
5. Pollen/anther

Quadrat photos X3



Nectar in male and female florets



Nectar studies require more time and detail – possible future research

S. purpurea Rubra PN221



***S. purpurea* good nectar source**

S. purpurea (Links Dutch) PN382



Summary

- data entry and analysis ongoing now
- several criteria to select best nutrition
 - estimates of amount of pollen
 - protein in pollen (samples go to GNS Science)
 - flowering sequences for purpose planting
- dissemination of info (booklet, posters)
- trials on apiary farms

Questions remaining

- Sterility of some accessions
- Gender of some accessions
- Nectar production
- Protein variability in pollen