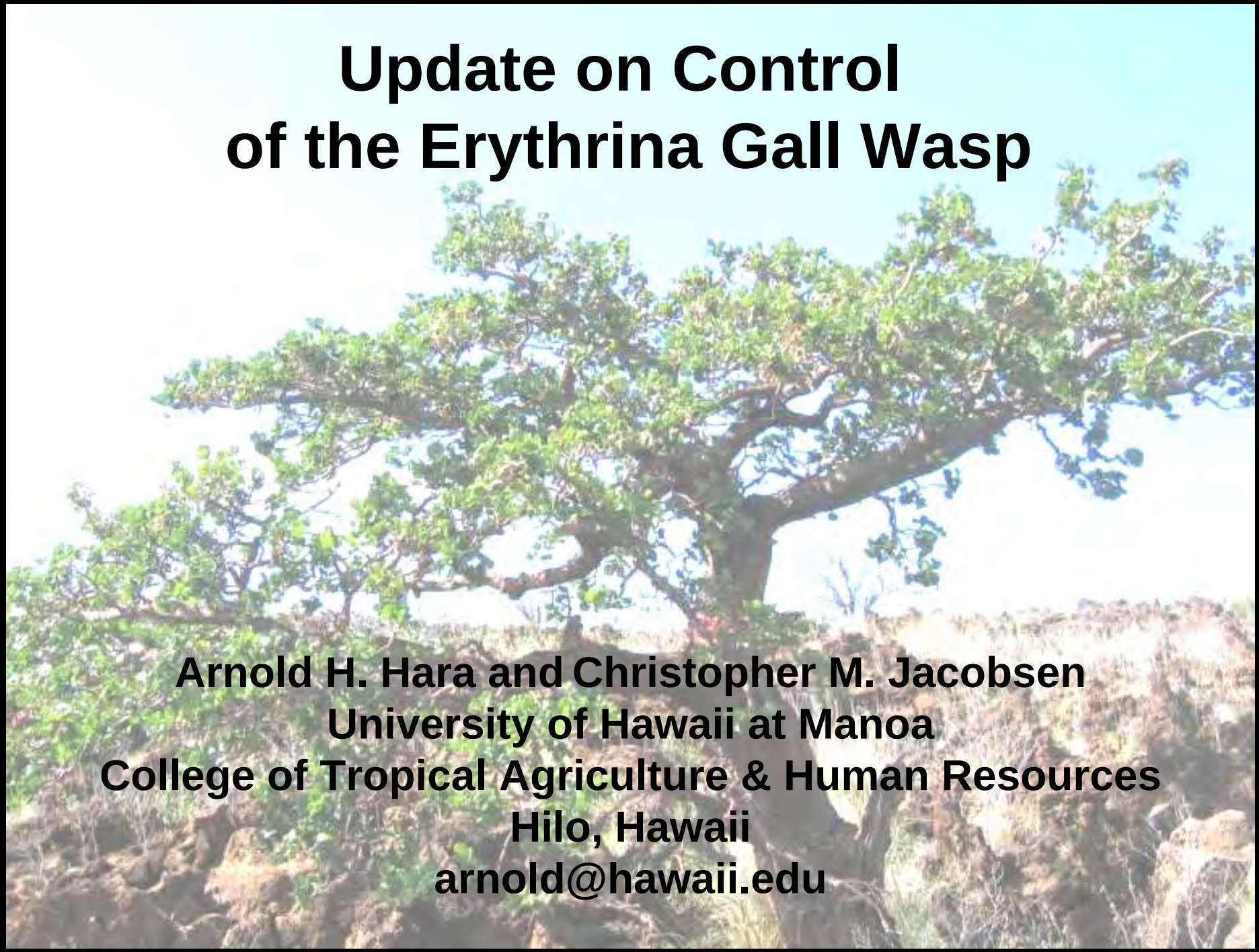
Update on Control of the Erythrina Gall Wasp



Arnold H. Hara and Christopher M. Jacobsen
University of Hawaii at Manoa
College of Tropical Agriculture & Human Resources
Hilo, Hawaii
arnold@hawaii.edu

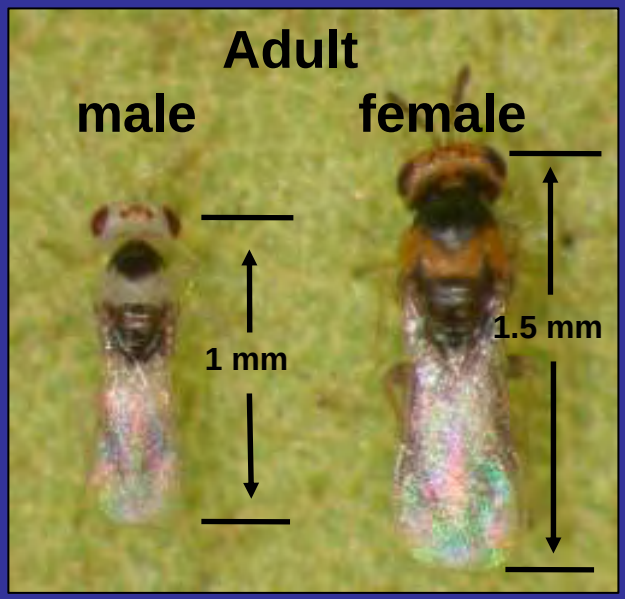
D. Ogata

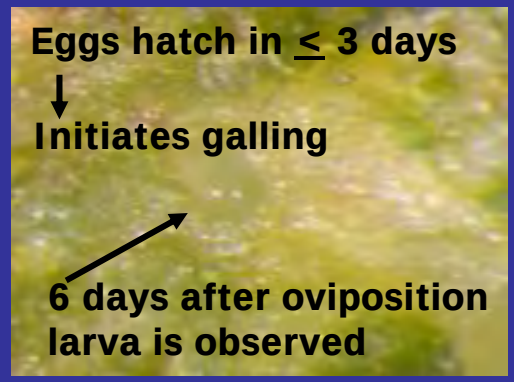
Erythrina = Wiliwili Gall Wasp

Spread was like a wild fire

- **First described in 2004 causing severe damage in Taiwan and Singapore.**
- **First found on Oahu in April 2005.**
- **Found in Big Island, Kona, Kauai, and Maui in July 2005.**

EGW Life Cycle – Egg to adult in 21 days





Yalemar, Nagamine, Heu HDOA

Summary of the Life Cycle of EGW

- **Life cycle**
  egg to adult – 21 days

- **Ovipositional preference**
  female lays eggs in young terminal growth

- **Sex ratio**
  7♂ : 1♀, more males emerge first

- **Adult longevity**
  without honey: ♂ and ♀ = about 2-3 days
  with honey (nectar) : ♂ =10 days, ♀=6 days
- **Fecundity**
  female wasp emerges with about 85 mature eggs

Yalemar, Nagamine, Heu and Ramadan HDOA

HOSTS

Healthy

Gall Wasp Injury

**tiger's claw,
Indian coral tree**

**tall erythrina,
tall wiliwili**

Erythrina crista-galli
common coral tree

Most Threaten Species in Hawaii

Native wiliwili

Erythrina sandwicensis

Major Control Strategies

Short Term:

Chemical Control

Drenches and Injections

Long Term:

Biological Control

Natural Enemies from Africa

Cultural Control

Remove & Replace

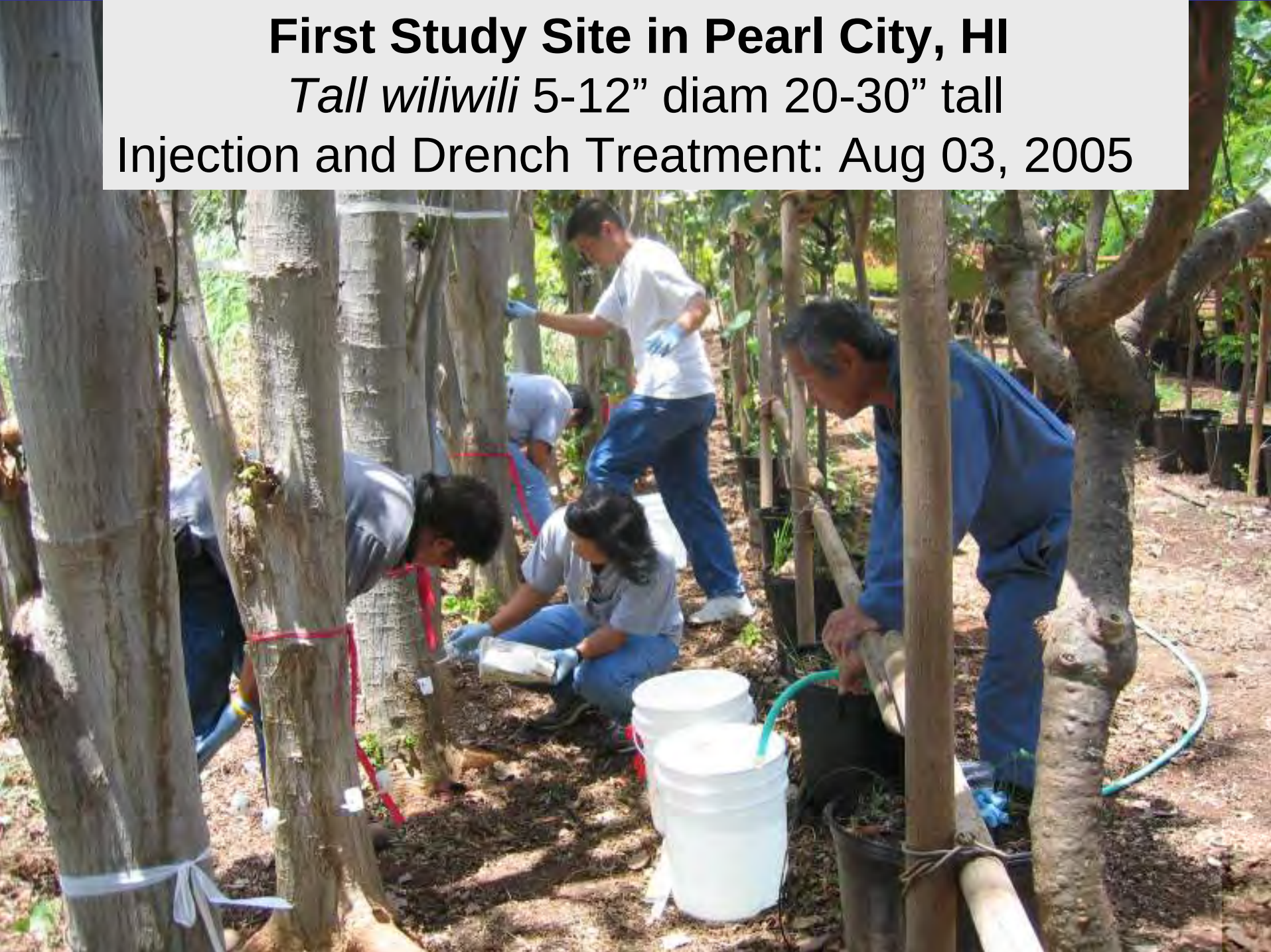
CHEMICAL CONTROL

Application	Tradename	Common name
Foliar	Sevin	carbaryl
Systemic		
Drench	Merit	imidacloprid
& Foliar	Safari	dinotefuran
	Orthene	acephate
Injection		
Maujet	Imicide	imidacloprid
	Abacide	abamectin
Wedgle	Pointer	imidacloprid
Sidewinder	Imicide	imidacloprid
Arborjet	IMA-jet	imidacloprid

First Study Site in Pearl City, HI

Tall wiliwili 5-12” diam 20-30” tall

Injection and Drench Treatment: Aug 03, 2005



Treatments

Treatment	Rate
Imicide 10% injection (imidacloprid)	4 ml per capsule; no. of capsules= in diam/2
Merit 2 F drench (imidaclorpid)	0.2 fl oz per 1 in trunk diam Delivered in 10 gal drench
Safari 20 SG drench (dinotefuran)	4oz/tree in 10-gal drench
Abacide 1% injection (abamectin)	2 ml per capsule; no. of capsules= in diam/2

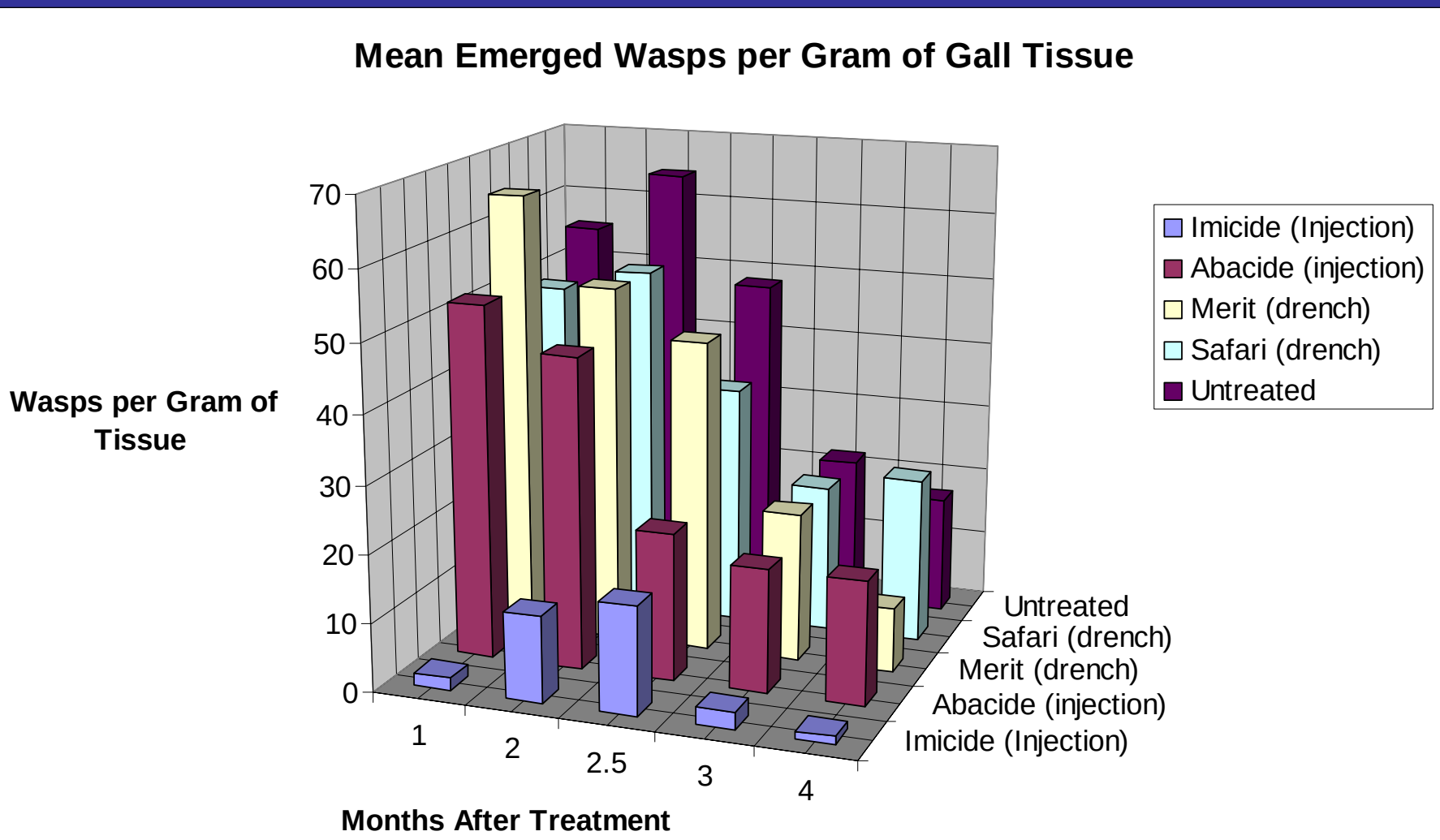
Applying Treaments

Drilling

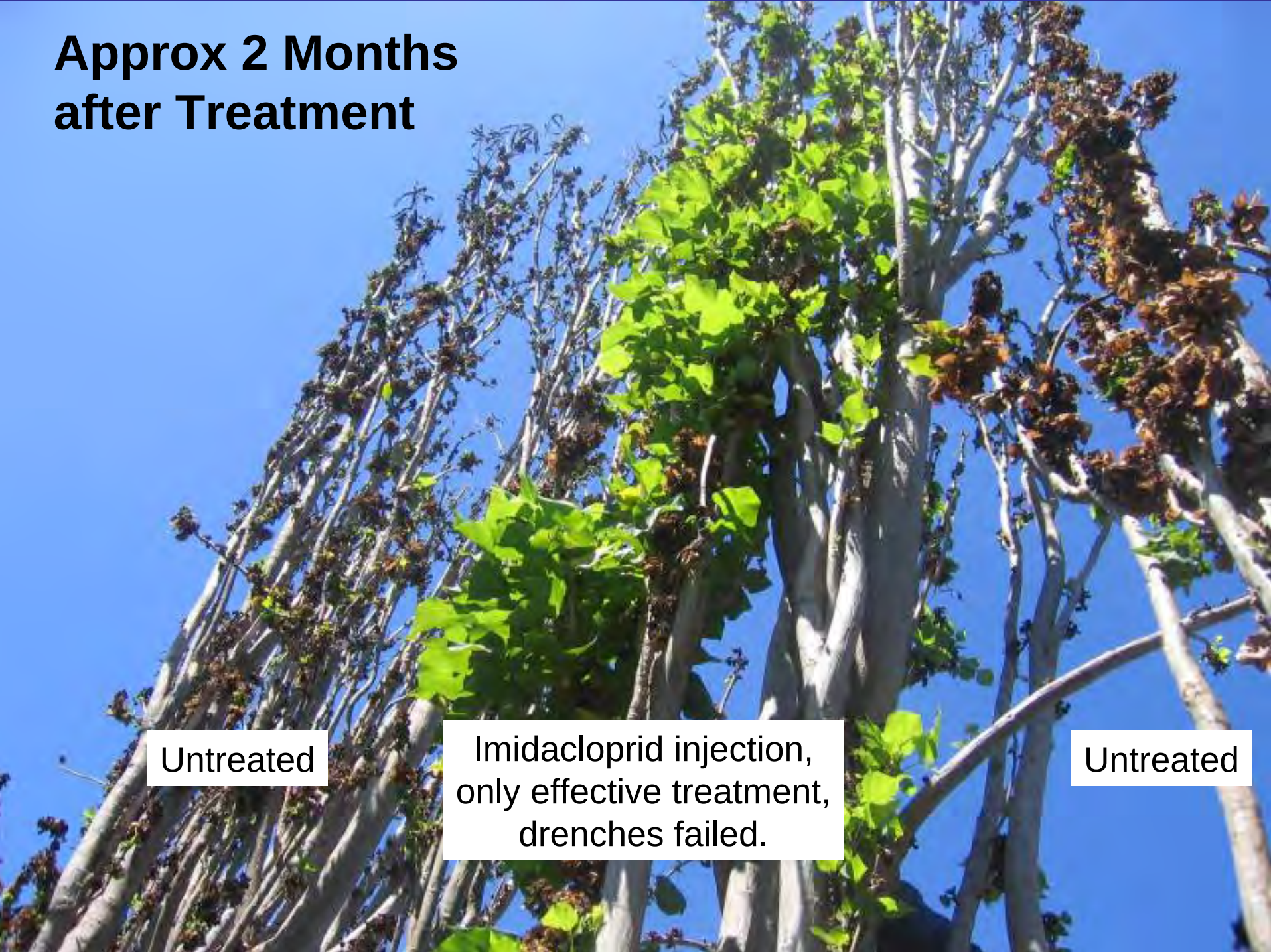
Injecting

Trenching

Drenching


Mean Emerged Wasps per Gram of Gall Tissue
Wasps per Gram of Tissue
70
60
50
40
30
20
10
0
1
2
2.5
3
4
Months After Treatment
Untreated
Safari (drench)
Merit (drench)
Abacide (injection)
Imicide (Injection)
Imicide (Injection)
Abacide (injection)
Merit (drench)
Safari (drench)
Untreated

Approx 2 Months after Treatment



Factors Contributing to Effective Drench Treatment

*Evidently wiliwili root systems make it difficult to get good systemic uptake. Roots are often sparse and spread across a large area.

*Drenches of roots may be best for containerized trees, trees with confined irrigated root systems, or small establishing trees. Liquid fertilizer added to insecticide may assist uptake.

*Competition by neighboring plants or turf increase the uptake problem.

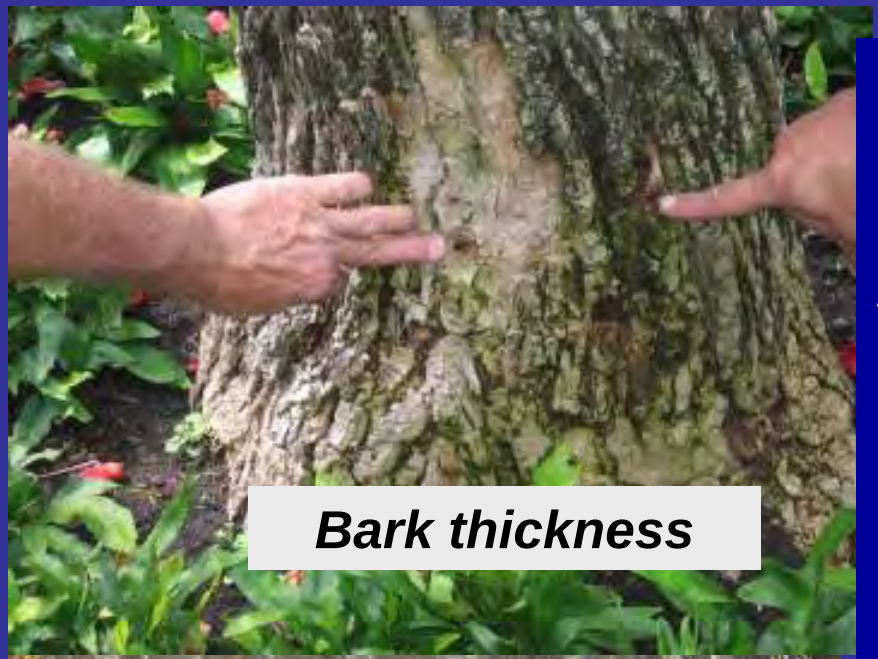
Successful Merit and Safari drench of tall wiliwili with confined irrigated root system.

Injection Systems Evaluated


Sidewinder Tree Injector


Mauget Tree Injectors

FACTORS AFFECTING INJECTION EFFICACY



- These injection systems have a steep learning curve to get positive repeatable results.

*Major problem is failed uptake, due to inaccurate chemical placement or bleeding at injection location.

-Bark thickness affects critical depth of injection into the active cambium area for uptake.

-Trees under water stress and/or no functional leaves will not translocate injected insecticide with lots of “bleeding”.

Each System Advantages and Disadvantages

Injection System	Advantages	Disadvantages	Cost of System Cost per Tree (20" dia)
ArborSystems Wedgle Direct-Inject	Least wounding of tree trunk among systems. Injection has no waiting period for uptake.	Bleeding of chemical during injection. The least quantity of AI is applied of any system .	$605 for Wedgle Direct-Inject Pointer $305/ 120ml (5% AI) $28-41
Arbor jet Tree IV Micro Infusion System	Injects the largest volume of insecticide through the fewest injection sites. Able to see chemical uptake.	Requires drilling. Longer injection time (usually15-20min can be up to 1 hr). System not as portable for remote forest situation..	$699 for 2 tree IVs & kit; $315 for each additional IV IMA-jet $175/ 500ml (5% AI) $56
Mauget Ready to use 3ml Micro injector Capsules	Formulation ready for injection. Able to see chemical uptake.	Requirs drilling . Passive system; tree does not always uptake product. Some bleeding.	Imicide $116 for 24, 3ml capsules (10% AI) $48
Sidewinder Tree Injectors Backpack Tree Injector	Complete unit is carried on the back and includes drill and injection equipment. No waiting for uptake.	Requires drilling, Occasional bleeding. Difficult to assure the entire dose was administered.	$1584 for Backpack Injector System. Insecticide is from other manufacturers following their labeled rates.

Injection and Drench Efficacy Test on Tall Erythrina

10 Weeks After Treatment

Treatment Formulation/ Equipment	Rate AI/ Inch Diameter	Galling Severity Rating	Emerged Wasps/g Tissue	Imidacloprid Concentration µg/g
Untreated	-------	5 a	21 a	0 a
Imicide/ Mauget Capsules 10%AI	0.15 ml	3 ab	9 bc	3 a
Pointer/ ArborSystems Wedgle 5% AI	0.026 ml	3 ab	5 c	7 ab
Merit 200 SL/ Arbor Jet Tree IV 17.1%AI	0.77 ml	3 ab	9 bc	39 b
IMA-jet/ Arbor Jet Tree IV 5% AI	0.40 ml	2 b	1 c	321 c
Merit 2/ Root Drench 2% AI	1.28 ml	4 a	16 ab	0.2 a

Means in a column followed by different letters are significantly different by Tukey's multiple comparison procedure ($P<0.05$).

Tall or Windbreak Erythrina 12 Weeks After Injection with and without Imidacloprid

Treated trees showing concentration effect with different injection system and imidacloprid formulations

*Full expanded undamaged leaves on lower portion of imidacloprid injected tree.

*Translocation of Imidacloprid visually observed with undamaged leaves progressing up the tree within weeks.

Summary of Chemical Control Trials

*Effective drenching of wiliwili trees has not been consistent probably because of its root system; roots are often sparse and spread across a large area.

*Injection systems have a steep learning curve to get positive repeatable results. Must be used properly.

*Major problem is failed uptake, due to inaccurate chemical placement or bleeding at injection location.

*Imidacloprid injection can be highly effective if an adequate dose is delivered by the injection system.

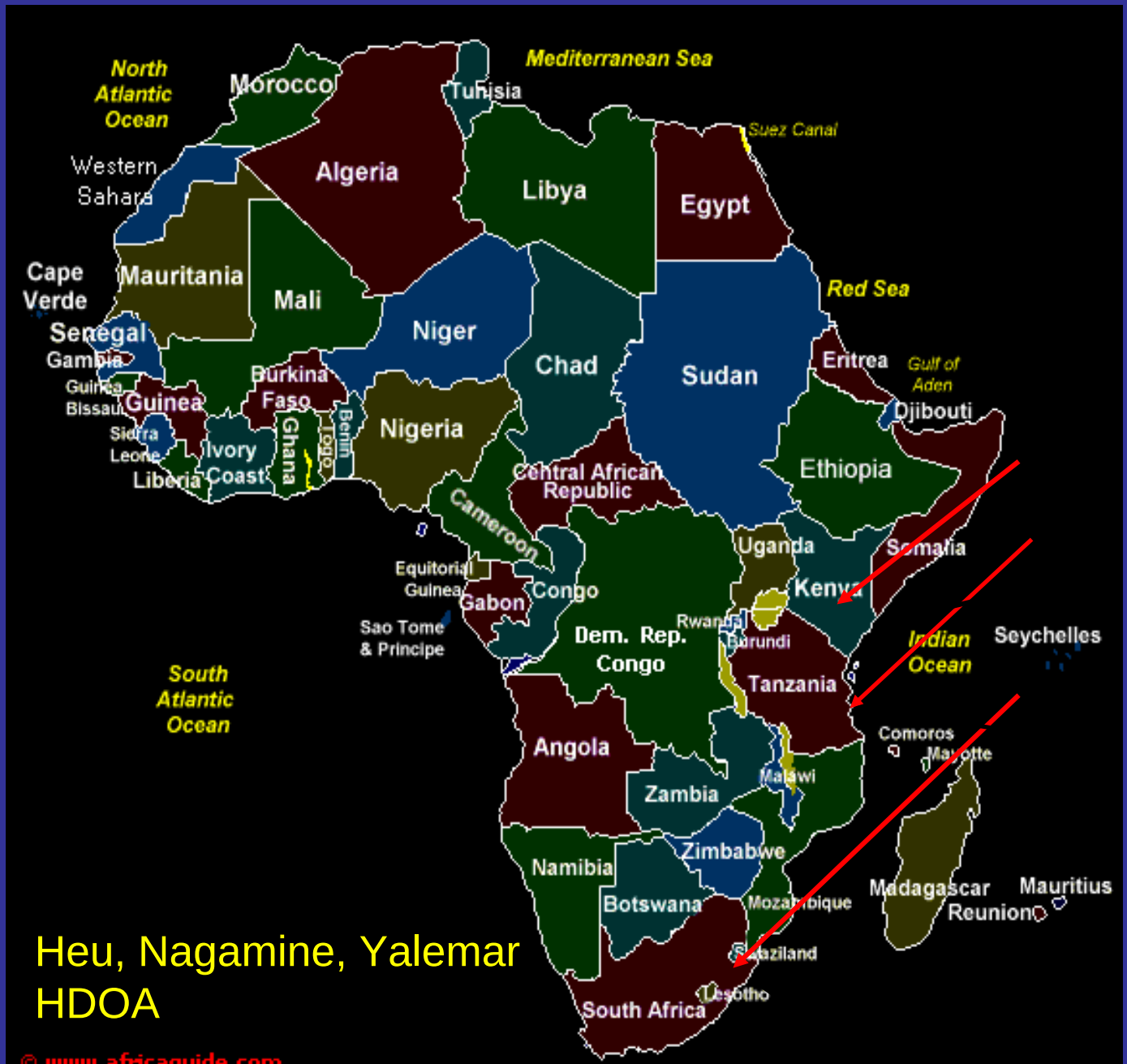
*Another application technique to be tested is the use of a bark penetrant with imidacloprid for systemic deliver into the vascular system.

Long Term Control of EGW
Classical Biological Control

*Failed containment efforts evolve to biological control.
*Practiced in Hawaii for over 100 years by Hawaii Dept. of Agriculture (HDOA).
*Exploration, Importation, Host-Range Testing, Release.
*Over 680 species of biological control organisms released in Hawaii since 1890.
*Over 36% have established attacking over 200 pest species.
*No biological control agent approved for release in the past 35 years has been recorded attacking any native or desirable species.

(Funasaki et al. 1988)

Search for Natural Enemies of the Gall Wasp in Africa



Heu, Nagamine, Yalemar
HDOA

Tanzania & South Africa

HDOA Exploratory Entomologist, Dr. Mohsen Ramadan has discovered and imported promising parasitic wasps the HDOA quarantine lab.

South Africa & Kenya

UH - CTAHR Cooperators w/ HDOA Drs. Messing, Wright, Rubinoff recently returned from Africa.

Biological Control Agents for Against the Gall Wasp

*The biology and host specificity testing for three potential biological control agents has been completed by the Hawaii Dept of Agriculture (HDOA) and UH-CTAHR.

W. Nagamine

Eurytomid wasps from Tanzania

*A best case scenario will be for releases to begin in Sept or Oct 2007.

*This eurytomid wasp was collected by HDOA exploratory entomologist Mohsen Ramadan. HDOA entomologists are cautiously optimistic that it will have a dramatic impact on the gall wasp populations. Eurytomids may encounter negative impacts such as other parasitoids (hyperparisitoids) preying on them.

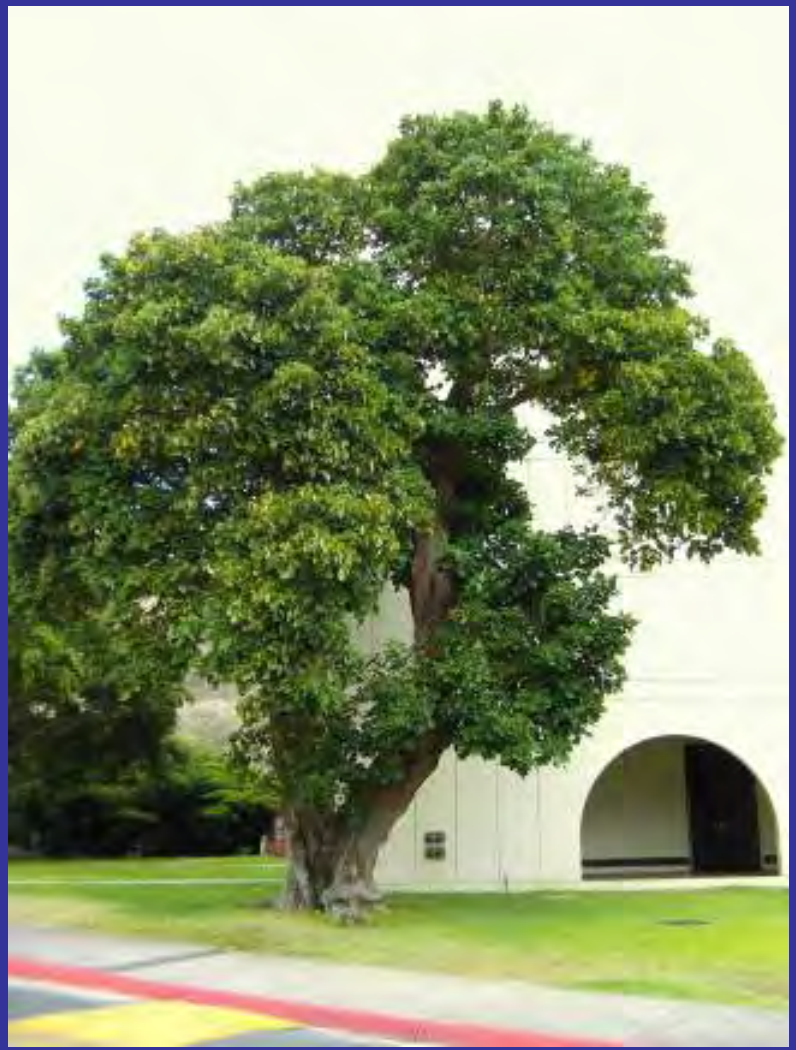
Long Term Cultural Control of EGW

*Replacement Species for windbreak = Panax? Others

Bill Durston of Leilani Nursery in Waimanalo, Hawaii suggested this variety of Panax to replace tall wiliwili

Long Term Cultural Control of EGW

*Tolerant or resistant species of *Erythrina* spp.



* A tolerant species observed on the UH-Manoa Campus and on Lanai by Criley, Leonhardt and Nagata of UH-CTAHR.

*Cuttings have been made to preserve and propagate germplasm of this unidentifed species.

Susceptible and Tolerant Coral Trees at Lanai Fairway Terrace, Manele, Lanai