

# Parasitic Mites (*Knemidokoptes jamaicensis*) Found in Hawai`i `Amakihi (*Hemignathus virens*) on the Island of Hawai`i: A New Threat to Hawaiian Honeycreepers?

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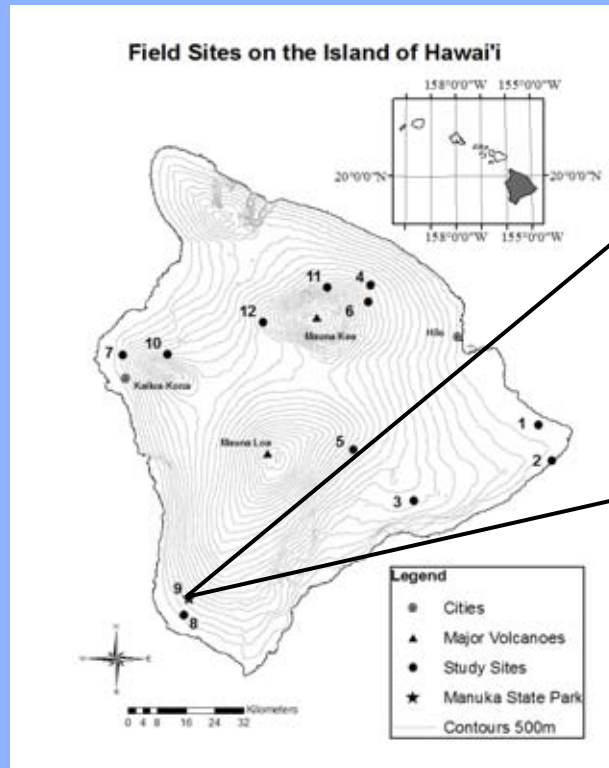
# Overview

- Time and place of first detection of mange in `amakihi
- Field and laboratory methods of species identification
- Demographics of affected `amakihi
- Background of *Knemidokoptes jamaicensis*
- Modes of introduction of *K. jamaicensis* to Hawai`i
- Modes of transmission of *K. jamaicensis* in `amakihi
- Implications & further investigations

# “Tempura feet”?

First Detection: June 14th, 2007

Manukā Natural Area Reserve  
& Manukā State Park, Ka`ū  
(1953 ft. elevation)



AHY Female



ASY Male

# Field Methods

- All `amakihi were mist-netted, measured, and banded with federal aluminum bands
- Lesion scrapings taken from 3 individuals exhibiting 3 different stages of mange (early, middle, advanced)
- Scrapings were stored in 95% ethanol
- All mist-nets and instruments with which affected `amakihi came in contact were disinfected



# Laboratory Methods

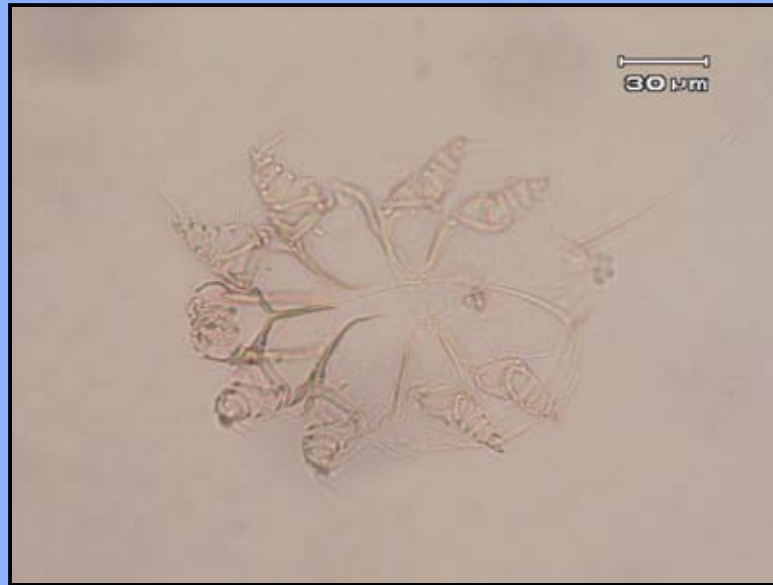
- Scrapings were cleared with 10% KOH and ecto-parasites found were cleared with 1:1 lactic acid to glycerol solution (see Krantz 1978)
- Specimens mounted in Hoyer's medium onto slides for species identification by James W. Mertins
- Voucher specimens deposited in USDA-National Veterinary Services Laboratory (Ames, Iowa) and The Bishop Museum (Honolulu, Hawai`i)





# *Knemidokoptes jamaicensis*

“scaly leg mite”



Male



Female

- The entire three-week life cycle is spent on the bird host
- Mites burrow into the epithelium, forming tunnels
- Mites feed on keratin
- Transmitted by direct or prolonged close contact between birds

(Wade 2006)

# Distribution of *Knemidokoptes jamaicensis*



Original world map from: [www.gl.iit.edu](http://www.gl.iit.edu)

(Turk 1950; Fain & Elsen 1967; Voinov et al. 1978; Kirmse 1996; Pence et al. 1999; Latta & O'Connor 2001; Latta 2003; Gaudioso et al. accepted)

# Demographics of affected individuals at Manukā

Bird ID	Sex	Age	Mange status
231144489	F	AHY	Advanced*
231144556	M	AHY	Early*
231144613	M	AHY	Early
231144483	M	AHY	Early
231144649	M	AHY	Advanced
231144616	M	AHY	Advanced
231144656	M	ASY	Advanced
232152653	U	HY	Early
231144640	U	HY	Middle*

**9/34** `amakihi  
(new captures)  
affected  
= **26.5%**

$n_F = 9$   
 $n_M = 14$   
 $n_U = 11$

\* Scrapings taken  
(Gaudioso et al. accepted)



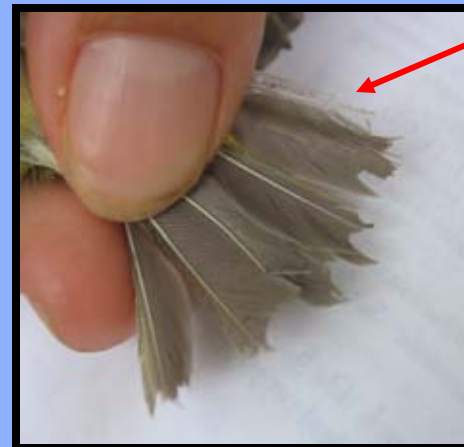
# Stages of knemidokoptic mange



**Early**



**Middle**



**Advanced**

# How does knemidokoptic mange affect amakihi condition?

## Average mass (grams) by mite presence

	<b>Total</b>	<b>Females</b>	<b>Males</b>	<b>Sex Unknown</b>
<b>No mange</b>	11.77 g N=25	11.60 g N=8	12.15 g N=8	11.53 g N=9
<b>Mange</b>	11.64 g N=9	11.90 g N=1	11.53 g N=6	11.85 g N=2
	p = 0.370	p = n/a	p = 0.146	p = 0.364

# Knemidokoptid mites in Hawai`i:

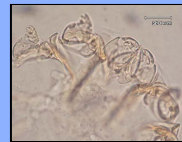
## What we know:

1. Knemidokoptid mites were not found in `amakihi in an island-wide study of parasites (vanRiper 1991)
2. Knemidokoptid mites were not found during past studies in the Manukā region (C. Atkinson & E. VanderWerf, personal comm.)
3. Only *K. mutans* and *N. gallinae* found in domesticated chickens in Hawai`i (Bice 1932)
4. *K. pilae* found in caged parakeets on Oahu (Goff 1987)

# It 'mite' have been introduced via...

## An opportunistic host shift

- *Is a non-native species found on Hawai'i Island harboring *K. jamaicensis*?*



- *Was *K. jamaicensis* recently introduced to Manukā via a released, domesticated or feral bird?*

# It 'mite' be transferred by....

D  
I  
R  
E  
C  
T

## **Copulatory transfer**

- *Are mites being transferred directly during mating?*

## **Parent-offspring transfer**

- *To what extent are mites transferred from parents to offspring in the nest?*

I  
N  
D  
I  
R  
E  
C  
T

## **Transfer due to aggregations**

- *Are mites being transferred by prolonged contact during aggregations (i.e., communal roosting)*

## **Phoretic transfer**

- *Does a vector for *K. jamaicensis* exist (i.e., hippoboscid flies; Jovani et al. 2001)?*

## **Sex-specific behavior**

- *Is the transfer of mites a result of a sex-specific behavior in 'amakihi (i.e., male-male competition)?*



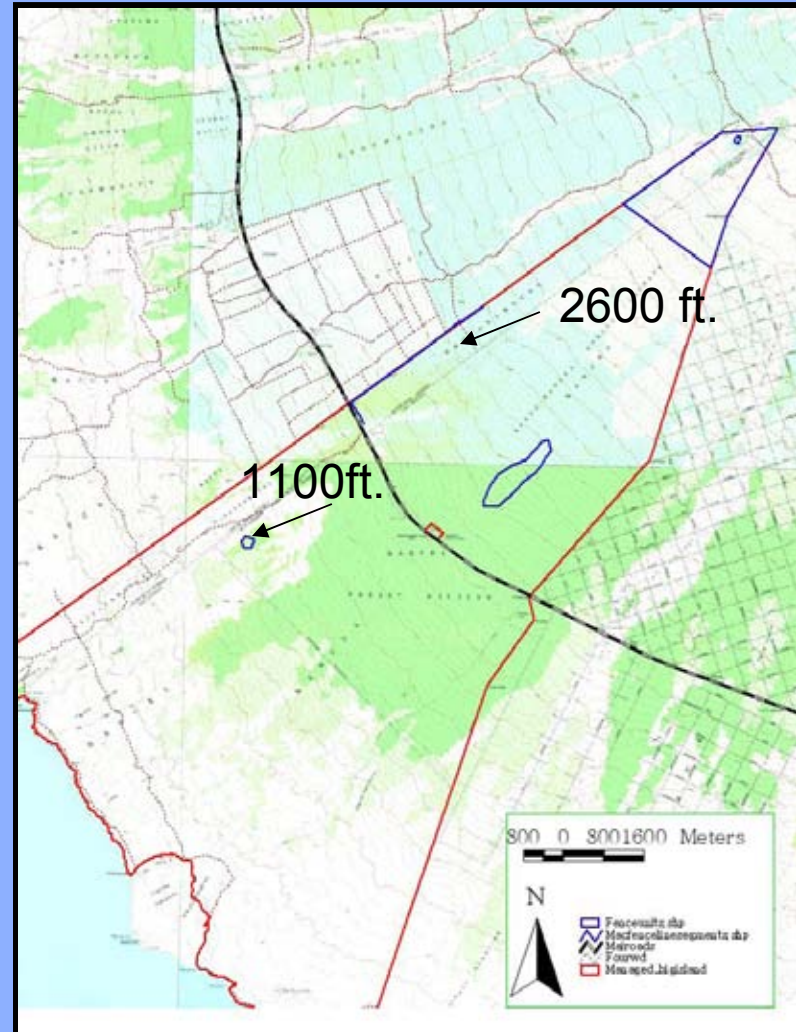
# A new threat to Hawaiian honeycreepers?

- **Long-term effects:** Severe mange can cause deformities, inability to perch, preen, and forage (Pence et al. 1999)
- **Immuno-compromised:** Does malarial or pox infection facilitate infestation of Knemidokoptid mites?
- **Parasite specificity:** What other native bird species are susceptible to knemidokoptic mange?
- **Distribution of *K. jamaicensis* in Hawai`i:** Does *K. jamaicensis* exist elsewhere in Hawai`i?
- **Optimal environmental & biogeographical conditions:** Why Manukā? (i.e., rainfall, elevation, vegetation structure (Latta & O'Connor 2001))



# Further investigations

- Expand the range of mist-netting in the Manukā Natural Area Reserve
- 2 proposed sites at Manukā NAR: **1100 ft.** and **2600 ft.**
- Capture feral chickens and potential invertebrate vectors to identify modes of introduction and transmission
- Arrange a working group to address management options



Map courtesy of NARS/DOFAW



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