

**Results of the 2006 Wēkiu Bug  
(*Nysius wekiuicola*) Surveys  
on Mauna Kea, Hawai‘i Island**

**Hawaii  
Biological  
Survey**

**Final Report**

**April 2007**

**RESULTS OF THE 2006 WĒKIU BUG (NYSIUS WEKIUCOLA) SURVEYS  
ON MAUNA KEA, HAWAI'I ISLAND**

**FINAL REPORT**

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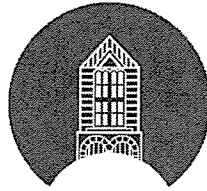
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## **EXECUTIVE SUMMARY**

As part of a continuing long-term study, the Hawaii Biological Survey of the Bishop Museum was contracted by the Office of Mauna Kea Management (OMKM) to continue its study of the distribution and habitat use of the wēkiu bug (*Nysius wekiuicola* Ashlock and Gagné), which is endemic to the Mauna Kea summit area. Two ten day field trips to study wēkiu bug ecology and distribution occurred in April and May 2006. Another week-long field trip was conducted in October 2006 to retrieve data from temperature loggers that had been installed various locations throughout the Mauna Kea summit in 2005.

Along with collecting wēkiu bug distribution and temperature data, a trapping study continued to determine whether current or historical trapping methods influence wēkiu bug catch effectiveness. Ethylene glycol traps (similar to traps used in earlier studies) and shrimp pitfall traps have been placed in a pairwise fashion at the summit of Pu'u Hau Kea since 2002. In contrast to the pitfall trapping tests conducted since 2002 that had relatively similar results, ethylene glycol traps were much more effective, with 43 wēkiu bugs captured in glycol traps in both April–May 2006 as compared to only one captured in shrimp traps during the same time period. Because much of the snow had not melted by the end of April 2006, no wēkiu bugs were collected in any type of trap during the April testing. Because these results were so dramatic and the glycol traps have proven to be so effective, the pitfall trapping test has now been terminated.

In 2006 sample effort for wēkiu bugs reached an all time high, with 1048 trap days compared to the previous high of 911 trap days in 2005. The major findings of this study were that the snowy winter of 2005-2006 created ideal conditions for a long-lasting snowpack that appeared to provide favorable conditions for wēkiu bugs. It was previously postulated that an increased snowpack will favor wēkiu bugs because a long-lasting snowpack will provide greater long-term forage opportunities for the eolian drift insects preserved in the snow. Wēkiu bug captures from the 2006 field season appear to confirm this hypothesis, as a record number (114 individuals) were either observed or collected around snowbank areas.

We also found that wēkiu bug activity did not start until 10 days had elapsed after a large series of snow storms that ended on April 2, 2006. When we finally started observing wēkiu bugs on April 13, 2006 much of the snow had melted except for large patches around the summit areas. That none were collected in traps during our April 2006 field trip despite our intensive trapping and visual observations, indicating that wēkiu bugs remain inactive

*Hawaii Biological Survey Report on the 2006 Wēkiu Bug Sampling Results*

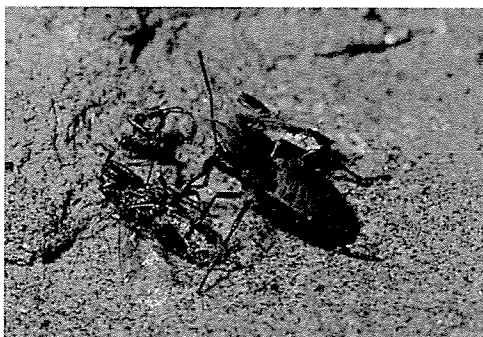
for some time after a period of heavy snow. The bugs must have penetrated fairly deep into the substrate to get away from the surface layer of snow that was over 2-3 m thick drifts in many summit areas.

During the 2006 field season, the nunatak hypothesis postulated by Porter and Englund (2006) for wēkiu bug distribution was successfully tested. This hypothesis states wēkiu bug distribution is related to topography, and that wēkiu bugs currently inhabit only areas of the summit that represented ice-free refugia inside the limit of the glacial ice cap that reached its maximum size about 20,000 years ago, and disappeared by about 16,500 years ago. By examining the geology of unsampled cinder cones, and also unsampled areas of previously sampled cones a predictive list was compiled for environmentally promising habitats to sample for additional bug populations. Several significant and new bug populations were found using these predictions, most notably in areas adjacent to the VLBA facility and areas around the adze quarry.

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Table 3. Wēkiu bug capture data from surveyed Mauna Kea cinder cones using visual collections, shrimp pitfall, and ethylene glycol pitfall traps in April, May, and October 2006.

Cinder Cone	2006 Capture Date	Trap #	Elevation	GPS Coordinates	Wēkiu #'s	Trap Type
Pu'u Hau Kea	Apr 13	Vis	4,124 m	19.81323°N 155.47220°W	1	Jesse
Pu'u Hau Kea	Apr 13	Vis	4,122 m	19.81330°N 155.47217°W	3	Heather
Pu'u Hau Kea	Apr 13	Vis	4,128 m	19.81327°N 155.47209°W	2	Heather
Pu'u S. VLBA	Apr 13	Vis	3,787 m	19.79994°N 155.45573°W	6	Ron/Adam
Pu'u N. VLBA	Apr 13	Vis	3,860 m	19.81323°N 155.47220°W	1	Jesse
<b>April 2006 Subtotal</b>					<b>13</b>	
Pu'u N. VLBA	11 May	Vis	3,852 m	19.80341°N 155.45871°W	3	Ron
Pu'u S. VLBA	12 Apr–11 May	1	3,809 m	19.79922°N 155.45583°W	9	Glycol
S.E. Boundary Cone	12 May	3	3646 m	19.79797°N 155.44054°W	2	Shrimp
S.E. Boundary Cone	12 May	5	3642 m	19.79799°N 155.44093°W	1	Glycol
Pu'u Hau Kea	12 May	2g	4121 m	19.81432°N 155.47331°W	2	Glycol
Pu'u Hau Kea	14 May	Vis	4,125 m	19.81469°N 155.47314°W	1	Jesse
Pu'u Hau Kea	14 May	Vis	4,124 m	19.81445°N 155.47327°W	2	Jesse
Pu'u Hau Kea	14 May	2g	4,121 m	19.81432°N 155.47331°W	4	Glycol
Pu'u Hau Kea	14 May	1g	4,130 m	19.81432°N 155.47331°W	1	Glycol
S.E. Boundary Cone #1	14 May	3	3,646 m	19.79797°N 155.44054°W	3	Shrimp
Below Keck & Subaru	15 May	4	4,152 m	19.82541°N 155.47495°W	2	Shrimp
Below Keck & Subaru	15 May	5	4,152 m	19.82508°N 155.47603°W	7	Shrimp
Below Keck & Subaru	15 May	1	4,096 m	19.82378°N 155.47542°W	10	Shrimp
Near road below Keck	15 May	3	4,164 m	19.82378°N 155.47542°W	3	Jesse
Pu'u N. VLBA	9 Apr–2 June	3	3,865 m	19.80368°N 155.45924°W	4	Glycol
Pu'u Hau Kea	17 May	2g	4,121 m	19.81432°N 155.47331°W	24	Glycol
Pu'u Hau Kea	17 May	4s	4,126 m	19.81376°N 155.47327°W	1	Shrimp
Pu'u Hau Kea	17 May	4g	4,126 m	19.81376°N 155.47327°W	12	Glycol
Pu'u Ko'oko'olau	17 May	1	3,817 m	19.79747°N 155.47453°W	1	Shrimp
Pu'u Hau Kea	17 May	vis	4,121 m	19.81432°N 155.47331°W	9	Heather/Ron
<b>May 2006 Subtotal</b>					<b>101</b>	
Pu'u Hau Kea	2 Oct 2006	vis	4,123 m	19.81370°N 155.47305°W	5	Ron
<b>October 2006 Subtotal</b>					<b>5</b>	
<b>2006 Total</b>					<b>119</b>	



Immature wēkiu bug preying on dead insects



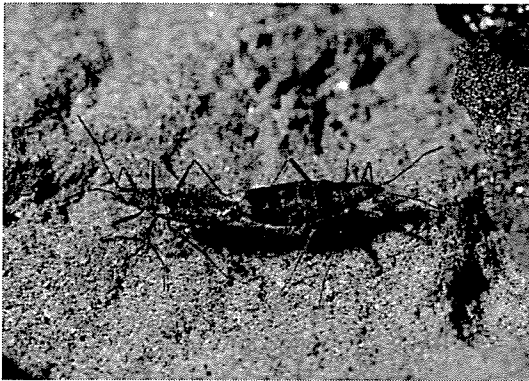
*Lycosa* sp., endemic to the Mauna Kea summit (RAE photos)

Hawaii Biological Survey Report on the 2006 Wēkiu Bug Sampling Results

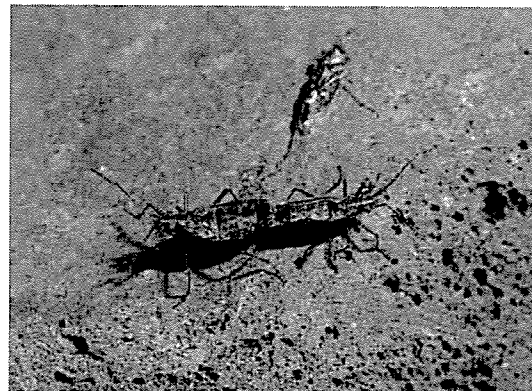
Table 4. Results of Pu‘u Hau Kea paired glycol and shrimp pitfall traps surveys during 4-13 April and 9-17 May 2006 (see Tables 1 and 2 for trap and GPS location information).

Trap Type	Trap #	# wēkiu bugs collected April	# wēkiu bugs collected May	# wēkiu bugs observed on caprock <sup>1</sup>	wēkiu Mortality (shrimp traps)
Ethylene Glycol	1g	0	1	0	n/a
Shrimp Pitfall	1s	0	0	0	0
Ethylene Glycol	2g	0	30	0	n/a
Shrimp Pitfall	2s	0	0	0	0
Ethylene Glycol	3g	0	0	0	n/a
Shrimp Pitfall	3s	0	0	0	0
Ethylene Glycol	4g	0	12	0	n/a
Shrimp Pitfall	4s	0	1	0	0
Ethylene Glycol	5g	0	0	0	n/a
Shrimp Pitfall	5s	0	0	0	0
Total Glycol		0	43	0	n/a
Total Shrimp		0	1	0	0

<sup>1</sup>Wēkiu bugs not collected within trap, but observed nearby around caprock near shrimp paste



Mating pair of Mauna Loa (*Nysius aa*) bugs



Mating pair of Wēkiu bugs (*Nysius wekiuicola*) (RAE photos)

Table 5. Summary of 2006 sample effort and wēkiu bug captures from surveyed Mauna Kea cinder cones using both shrimp pitfall and ethylene glycol pitfall traps in April 2006.

Cinder Cone	Highest Elevation	Total Traps	Wēkiu bugs in traps	Wēkiu bugs visual observation only <sup>1</sup>	Trap Dates	Total Trap Days <sup>2</sup>
Pu‘u Hau Kea	4,128 m	10	0	6	4-13 Apr	90
Pu‘u Waiiau	4,038 m	8	0	0	4-13 Apr	72
Pu‘u Hoaka	3,712 m	11	0	0	5-12 Apr	77
Glacier Cone	3,696 m	10	0	0	6-13 Apr	70
Pu‘u Ko‘oko‘olau	3,779 m	7	0	0	6-13 Apr	49
Horseshoe Crater	3,873 m	6	0	0	7-11 Apr	24
11,989 ft Pu‘u nr. Hoaka	3,672 m	10	0	0	8-12 Apr	40
Pu‘u N. VLBA	3,865 m	4	0	1	9-13 Apr	16
Pu‘u S. VLBA	3,821 m	4	0	6	9-13 Apr	16
Totals		70	0	13		454

<sup>1</sup>Number of wēkiu bugs hand collected around snowbanks and near traps during 20-30 minute trials by 2-3 observers, but not collected in traps. <sup>2</sup>Trap days = total nights x total traps per cinder cone.

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Table 6. Summary of 2006 sample effort and wēkiu bug captures from surveyed Mauna Kea cinder cones using both shrimp pitfall and ethylene glycol pitfall traps in May 2006.

Cinder Cone	Highest Elevation	Total Traps	Wēkiu bugs in traps	Wēkiu bugs visual observation only <sup>1</sup>	Trap Dates	Total Trap Days <sup>2</sup>
Pu'u Hau Kea	4,131 m	10	44	12	9–17 May	80
Pu'u Ko'oko'olau	3,824 m	6	1	0	9–17 May	48
Glacier Cone	3,698 m	6	0	0	9–17 May	48
Far Pu'u beyond VLBA	3,583 m	10	0	0	9–17 May	80
S.E. boundary cone (1 <sup>st</sup> Pu'u beyond VLBA)	3,654 m	9	6	0	9–17 May	72
Pu'u Hoaka	3,712 m	11	0	0	10–16 May	66
Pu'u Heather 11,989 ft	3,615 m	8	0	0	10–16 May	48
Pu'u nr. Mahoe	3,939 m	10	0	0	10–16 May	80
Pu'u Poliahu	4,173 m	8	0	0	11–15 May	32
Below Keck & Subaru	4,152 m	5	19	3	11–15 May	20
Pu'u 11,605	3,555 m	5	0	0	11–15 May	20
Pu'u N. VLBA	3,852 m	n/a	n/a	3	11 May	n/a
Pu'u S. VLBA	3,809 m	n/a	9	n/a	12 Apr–11 May	n/a
Pu'u N. VLBA <sup>3</sup>	3,865 m	n/a (1 glycol)	4	n/a	9 Apr–2 June	n/a
Totals		88 <sup>3</sup>	83	18		594

<sup>1</sup>Number of wēkiu bugs hand collected around snowbanks and near traps during 20-30 minute trials by 2-3 observers, but not collected in traps. <sup>2</sup>Trap days = total nights x total traps per cinder cone. <sup>3</sup>Glycol traps covered with snow drifts most of April/May 2006, not counted for trap days or traps total.

Table 7. Summary of Mauna Loa bug (*Nysius aa*) captures during brief field reconnaissance starting at MLO to Mauna Loa summit on 10 April and 13 May 2006.

General Location	2006 Date	Trap #	Elevation	Start Time/End Time of Trap	GPS Coordinates	Mauna Loa Bug #'s
Just above MLO	10 Apr	1a	3,419 m	1030-1830 hrs	19.53512°N 155.58151°W	1
Just above MLO	10 Apr	1b	3,419 m	1030-1830 hrs	19.53512°N 155.58151°W	0
Nr. trail-large cobble	10 Apr	2	3,800 m	1300-1740 hrs	19.51115°N 155.58395°W	0
Nr. trail-nr snow <sup>1</sup>	10 Apr	3	3,882 m	1320-1720 hrs	19.50543°N 155.57973°W	10
Nr. trail-nr snow <sup>1</sup>	10 Apr	Vis	3,882 m	1320-1720 hrs	19.50543°N 155.57973°W	3
<b>April 2006 subtotal</b>						<b>13</b>
Just Above MLO	13 May	1	3,437 m	1000-1704 hrs	19.53501°N 155.58150°W	0
Shelter Cave nr trail	13 May	2	3,662 m	1052-1630 hrs	19.52121°N 155.58308°W	0
Nr. trail-fine cinder <sup>2</sup>	13 May	3a	3,895 m	1200-1300 hrs	19.50520°N 155.57959°W	21
Nr. trail-fine cinder <sup>2</sup>	13 May	3b	3,895 m	1200-1300 hrs	19.50520°N 155.57959°W	14
Nr. trail-fine cinder <sup>2</sup>	13 May	Vis	3,895 m	1200-1300 hrs	19.50520°N 155.57959°W	15
By summit caldera	13 May	5	3,964 m	1400-1510 hrs	19.49359°N 155.57695°W	0
<b>May 2006 subtotal</b>						<b>50</b>

<sup>1</sup>90% gravel and 10% cobble substrate, 0.3 m from a 3m x 10 m snowbank. <sup>2</sup>Trapping and visual observations took place within a 30 m radius of this waypoint, on 5-25 mm fine cinder substrate.