

Collecting flies for genomic research: workflow at Smithsonian NMNH and Biorepository

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@TDikow #asiloidflies

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Smithsonian
National Museum of Natural History

- ◇ cryo-preservation facility at Museum Support Center
 - › 20 liquid nitrogen tanks (-190°C)
 - › 43 mechanical chest freezers (-80°C)
- ◇ new “type” of collection
 - › not taxonomically focused
 - › vial with mammal tissue right next to vial with insect specimen
- ◇ FreezerPro

› Biorepository



- ◇ Global Genome Initiative – GGI
 - › headquarter at NMNH
 - › Jonathan Coddington – director
 - › Seán Brady – research

- ◇ “Collect and barcode a synoptic sample of Earth’s genomic diversity ...”
- ◇ “Cryo-preserve 50% of the diversity of life in the next five years and make these collections available for research, with appropriate access and benefit sharing”
- ◇ “Increase computational support and technological capacity to sequence genomes”
- ◇ “Train the next generation of genomics researchers in biodiversity science”




- ◇ Global Genome Biodiversity Network – GGBN
 - › headquarter at NMNH
 - › bioinformatics at BGBM (Botanischer Garten und Botanisches Museum Berlin-Dahlem)
 - › currently 36 member institutions and five collaborating institutions
- ◇ “A global network of well-managed collections of genome–quality tissue samples from across the Tree of Life, benefiting society through biodiversity research, development, and conservation.”



This is currently a beta (β) version

GGBN Global Genome Biodiversity Network



Samples

DNA	65736
Tissues	55530
Enviros	61
Repositories	12

Vouchers

Cultures	21860
eVouchers	2
Specimens	27717
Unknown	1454
Collections	12

Taxa

Families	1643
Genera	6973
Species	20306

Total

172360

› GGBN

17449 records found (unique samples, not counting multiple samples from the same specimen).

The display is limited to 3000 records.

Your search:

Repository

NMNH, Washington (17449)



Refine search

Add selection

Show 25 entries

Scientific Name

[Ablautus coquilletti](#)

[Ablautus rufotibialis](#)

[Ablautus rufotibialis](#)

[Ablautus rufotibialis](#)

Identification

Name: *Ablautus coquilletti*

Taxonomy (Occurrence): Asilidae (family); Diptera (order); Insecta (class); Arthropoda (phylum); Animalia (kingdom);

Collection Info

Country: United States

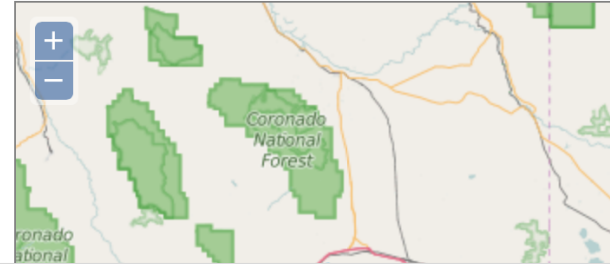
State/Province: Arizona

Locality: Willcox, 4 km S, intersection Route 186 + Moonlight Road

Coordinates (latlon): 32.2

Collector(s): T. Dikow

Collection Date: 09.May.20



Specimen

Catalog Number: AA6GE27 Entomology (USNM)

Record Basis: MaterialSample

GUID/Occurrence ID: AA6GE27

Sample Type / Kind of Unit: Whole Organism

Preparation

Preparation Date: 2005-5-9

Preparation Type: Whole individual organism

Sex: Female; Male

Preparations: Ethanol drained

Sample Preservation(s)

Preservation: Dried

> AA6GE27

- ◇ goal is to preserve specimens in liquid N₂
 - › not new methodology – done by vertebrate collectors for years and some entomologists
 - › allows both RNA and DNA to be sequenced
 - › we need to think about preserving specimens for genome sequencing!
- ◇ vouchers / exemplars
 - › extremely important to have vouchers / exemplars that are not in liquid N₂
- ◇ applying unique specimen identifiers in the field
 - › specimen records will be “connected” by unique identifiers
 - › separate identifier for pinned specimen, liquid N₂ specimen, and leg for COI barcoding
- ◇ recording specimen-level data in the field
 - › FIMS (Field Information Management System)
 - › import into EMu

- ◇ disclaimer
 - › research taxa (Apioceridae, Asilidae, and Mydidae) collected by hand-net
 - › one specimen at a time
 - › generic identification possible in field
 - › identification of conspecific specimens also possible
- ◇ I want to sequence genomes of asiloid flies for phylogenetic research!
- ◇ field work in southern Arizona and California in April 2015

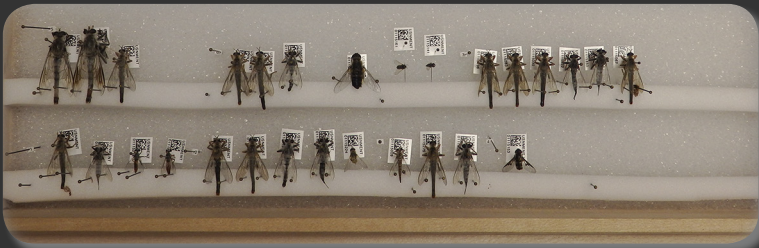


Scleropogon duncani in the field

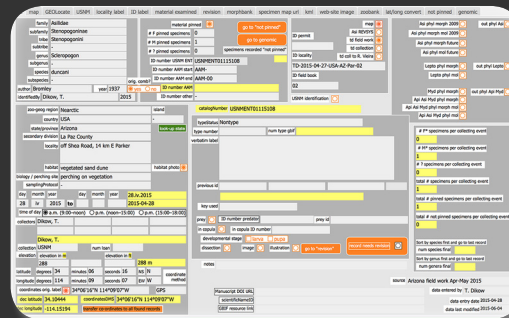


field site E of Portal, AZ

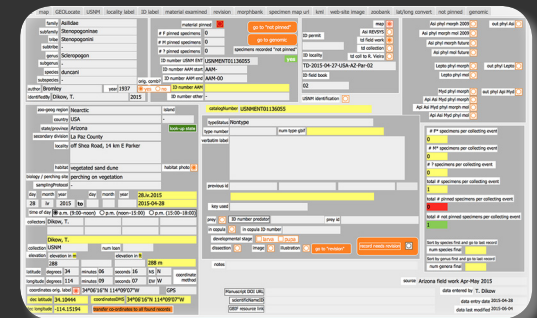
- ◇ in the field
 - › flies kept alive in individual vials at particular site
 - › once several specimens of same species collected, next few preserved in ethyl acetate for pinning
 - › specimens destined for liquid N₂ placed in a small cooler – later transferred to fridge at hotel
- ◇ in the evening
 - › flies pinned – unique identifier (USNMENTXXXXXX) attached to pin – record databased
 - › conspecific specimen placed in pre-labeled vial with two unique identifiers
USNMENTXXXXXX + Biorepository (AA8IQ05)



pinned flies in the field



USNMENT01115108 on pin



USNMENT01136055 + AA8IQ05 in vial

◇ in the evening

- › flies pinned – unique identifier (USNMENTXXXXXX) attached to pin – record databased
- › conspecific specimen placed in pre-labeled vial with two unique identifiers

USNMENTXXXXXX + Biorepository (AA8IQ05)

list | map | GEOlocate | USNM | locality label | ID label | material examined | revision | morphbank | specimen map url | kml | web-site image | zoobank | lat/long convert | not pinned | genomic

material liquid N2 material genomic leg
 # F liquid N2 specimens 0 # F genomic leg 0
 # M liquid N2 specimens 0 # M genomic leg 0

material RNAlater
 # F RNAlater specimens 0
 # M RNAlater specimens 0

material DNAgard
 # F DNAgard specimens 0
 # M DNAgard specimens 0

ID number USNM ENT USNMENT01115108 FIMS data-set name DikowAz20150427
 ID number NMNH Biorepository

is voucher (exemplar) Yes No
 is parent (voucher for a leg) Yes No
 is vouchered by by type Voucher Exemplar e-Voucher

genetic sample type primary Tissue & Parts Whole Organism plate ID
 genetic sample type secondary Leg Muscle Whole individual organism well ID

voucher type Voucher Exemplar e-Voucher

is voucher for USNMENT01146012 is exemplar for USNMENT01136055
 USNMENT01136006
 USNMENT01136029

back to list

USNMENT01115108 on pin

list | map | GEOlocate | USNM | locality label | ID label | material examined | revision | morphbank | specimen map url | kml | web-site image | zoobank | lat/long convert | not pinned | genomic

material liquid N2 material genomic leg
 # F liquid N2 specimens 0 # F genomic leg 0
 # M liquid N2 specimens 1 # M genomic leg 0

material RNAlater
 # F RNAlater specimens 0
 # M RNAlater specimens 0

material DNAgard
 # F DNAgard specimens 0
 # M DNAgard specimens 0

ID number USNM ENT USNMENT01136055 FIMS data-set name DikowAz20150427
 ID number NMNH Biorepository AA8IQ05

is voucher (exemplar) Yes No
 is parent (voucher for a leg) Yes No
 is vouchered by USNMENT01115108 by type Voucher Exemplar e-Voucher

genetic sample type primary Tissue & Parts Whole Organism plate ID
 genetic sample type secondary Leg Muscle Whole individual organism well ID

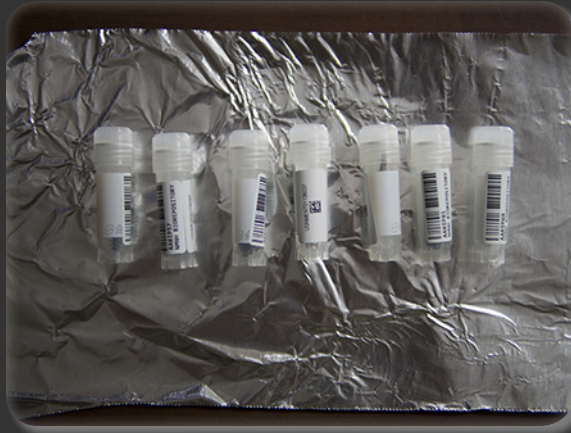
voucher type Voucher Exemplar e-Voucher

is voucher for USNMENT01146015 is exemplar for

back to list

USNMENT01136055 + AA8IQ05 in vial

- ◇ in the evening
 - › wrap vials in aluminum foil
 - › drop vials into liquid N₂ dry shipper



- ◇ in the evening
 - › take legs off for COI barcoding
 - › pinned exemplar specimen USNMENT01115108
 - › liquid N₂ specimen USNMENT01136055 + AA8IQ05
 - › new leg record USNMENT01146015

list map GEOLocate USNM locality label ID label material examined revision morphbank specimen map url kml web-site image zoobank lat/long convert not pinned genomic

material liquid N₂ material genomic leg back to list

F liquid N₂ specimens 0 # F genomic leg 0 ID number USNM ENT USNMENT01146015 FIMS data-set name DikowAz20150427

M liquid N₂ specimens 0 # M genomic leg 1 ID number NMNH Biorepository

is voucher (exemplar) Yes No

material RNAlater

F RNAlater specimens 0 # F genomic leg 0 is parent (voucher for a leg) Yes No

M RNAlater specimens 0 # M genomic leg 1 is vouchered by USNMENT01136055 by type Voucher Exemplar e-Voucher

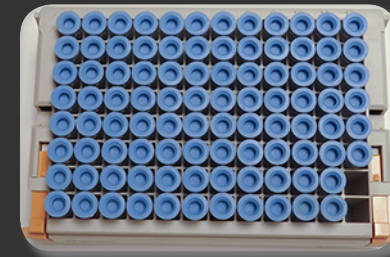
material DNAgard

F DNAgard specimens 0 # F genomic leg 0 genetic sample type primary Tissue & Parts Whole Organism plate ID DikowAz20150427-1

M DNAgard specimens 0 # M genomic leg 1 genetic sample type secondary Leg Muscle Whole individual organism well ID B04

voucher type Voucher Exemplar e-Voucher

is voucher for is exemplar for



USNMENT01146015 of hind leg

- ◇ pinned flies
 - › special label indicating exemplar status
 - › added to collection
- ◇ liquid N₂-preserved specimens
 - › added to Biorepository
 - › vial location recorded in FreezerPro based on unique identifier AA81Q05
- ◇ specimen / leg records uploaded from FIMS into EMu



Scleropogon duncani pinned specimens

- ◇ *Proctacanthus coquilletti*
 - › large fly (5 cm long) with plenty of thoracic muscle tissue
- ◇ sequenced DNA from one specimen on two lanes of HiSeq 2500 (goal 60x coverage)
- ◇ DISCOVAR *de novo* assembly
- ◇ genome
 - › size = 420 Million bp
 - › N50 = 790,000 bp
 - › 98% gene recovery (evaluated through BUSCO and OrthoDB)



Proctacanthus coquilletti in the field

- ◇ let's collect specimens for genome sequencing
- ◇ genomic diversity needs to be preserved now as it might vanish soon
- ◇ GGI and NMNH Biorepository would be happy to store your genomic specimens
 - › accessibility to these samples can be negotiated
- ◇ Mike Gates and Matt Buffington (USDA SEL) have workflow for parasitoid wasps

- ◇ data import and troubleshooting
 - › Patricia Gentili-Poole and Michael Lloyd
- ◇ NMNH Biorepository
 - › Chris Huddleston
- ◇ discussions
 - › Jonathan Coddington



presentation PDF doi: [10.6084/m9.figshare.1603023](https://doi.org/10.6084/m9.figshare.1603023)

Asiloid Flies blog: bit.ly/1j0BNXD



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