LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

EES Conference 2021
Poster Session

March 2, 2021

Schedule

11^{05}- Introduction to poster session I

11^{10}- Isabell Naumann. 3D models for image-identification in forensics

11^{13}- Kardelen Özgün Uludağ. Who evolves the best sperm?

11^{16}- Jelena Belojević. Mouth region of camel spiders- Morphological approach

11^{19}- Annika Neuhaus. How would you house a blue crane?

11^{22}- Morgan Oberweiser. Ants vs. Termites: SHAPE analysis of the functional head region of eusocial insects

11^{25}- Poster question breakout session

12^{15}- Lunch break

13^{15}- Introduction to poster session II

13^{20}- José Borrero. Role of habitat quality in nest-box occupancy, behaviour, and parental provisioning in great and blue tits

13^{23}- Stefan Dehos. Geometric morphometric analysis of potential hybridisation between cave bears (*Ursus spelaeus*) and brown bears (*Ursus arctos*) in the late Pleistocene

13^{26}- Rosalie Krause. Literature research and establishment of a database concerning Coronavirus prevalence in bats

13^{29}- Roberto Rebollo Hernández. The link between primary and secondary metabolism in the acclimation of Arabidopsis to cold

13^{32}-Maysan Nashashibi. Manipulating plant functional traits to control Senecio aquaticus in wet grasslands

13^{35}- Poster question breakout session

3D models for image - identififaction in forensics

Isabell Naumann[1]
Prof. Dr. Gisela Gruppe[1], Dr. Andreas Düring[2]

Ludwig-Maximilians-Universität[1], Institut für forensisches Sachverständigenwesen[2]

How precise are 3D Models created with photogrammetry software to simplify the image identification in the forensic context?

Introduction

The procedure of image identification to date has consisted of comparing individual features based on crime scene images and comparison images [1]. These should correspond as closely as possible to those of the crime scenes in all technical parameters [2]. In practice, the production of comparison images, for example from the same angle and under lighting conditions that correspond to those at the crime scene, is often difficult or impossible. This can result in shifts in proportions and shadows that make comparison difficult [3].

Working with 3D model software could be a solution.
This is because the 3D model can be adjusted to the angle according to the surveillance camera from the crime scene. 3D reconstructions can be used as an additional tool besides 2d photos in image identification [3].

The goal of the IRT was to test whether the creation of 3D models of living persons can facilitate image identification in a forensic context.

And if so, which program can create the best models in terms of quality.

Methods

FaceGen

AliceVision Meshroom

Agisoft Metashape

FaceBuilder for Blender

References

[1] Ritz-Timme, S., Gabriel, P., Tutkuviene, J., Poppa, P., Obertová, Z., Gibelli, D., . . . Barkus, A. (2011). Metric and morphological assessment of facial features: a study on three European populations. Forensic Sci Int, 207(1-3), 239. e231-239. e238.
[2] Verhoff, M., Kreutz, K., Jopp, E., & Kettner, M. (2013). Forensische Anthropologie im 21. Jahrhundert. Rechtsmedizin, 23(2), 79-84.
[3] Leipner, A., Obertová, Z., Wermuth, M., Thali, M., Ottiker, T., & Sieberth, T. (2019). 3D mug shot—3D head models from photogrammetry for forensic identification. Forensic Sci Int, 300, 6-12.

Procedure

3D Model created with Agisoft Metashape

Conclusion

Only Agisoft Metashape reproduces a true to original 3D model of the test person, thus can facilitate image identification in a forensic context.

WHO EVOLVES THE BEST SPERM ?

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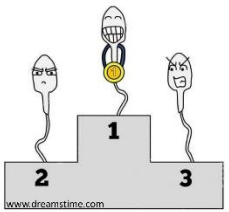
Introduction

Sexual Selection
Pre-mating

Post-mating



In polyandrous systems:

- Intense post-mating selection
- Increased sperm competition

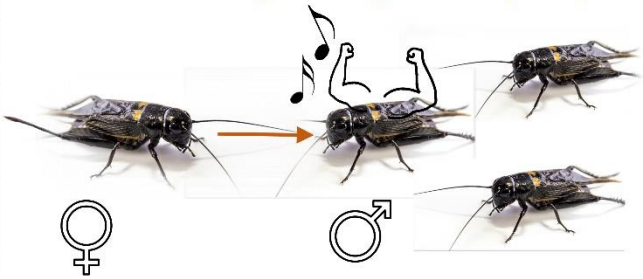
Hypothesis

Males evolving under post-mating selection evolve better quality sperm, **sperm viability** in our case, unless pre-mating traits are correlated to post-mating traits.

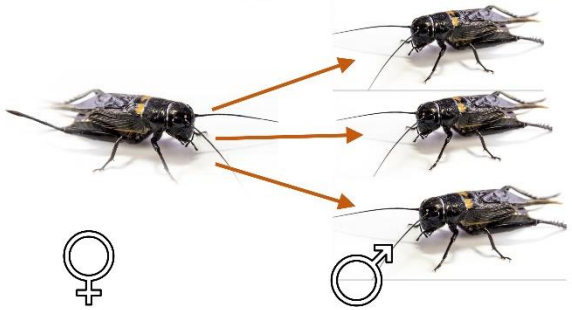
Methods

Experimental Evolution

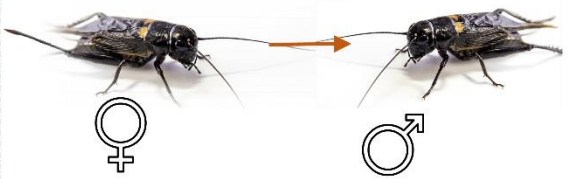
Pre-mating monogamous (PML)



Post-mating polyandrous (PPL)

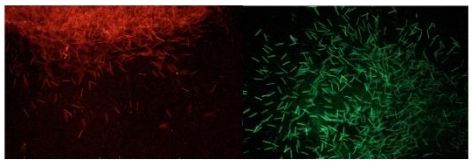


Control- No sexual selection (CL)

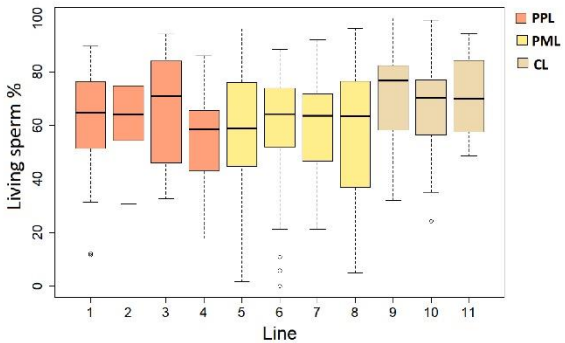


-Crickets from the 6th generation
-Generalized linear mixed effect model (negative binomial)

Results



Dead sperms *Living sperms*



Sperm viability for each line

Treatment: p=0.0883, Body mass: p =0.4919, Age: p=0.7763

Discussion and Conclusion

Why not treatment effect?

- Sperm viability might not be a trait under selection.
- Sperm viability might be determined by factors other than sexual selection.
- More generations might be needed.

Acknowledgments

I would like to thank Dr. Cristina Tuni, Magdalena Matzke, Annika Neuhaus, Aurora Rossi, and Morgan Oberweiser for their support and help in this project.

EES Con 2021

Mouth Region of Camel Spiders - Morphological Approach

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Background

Solifugae, Pseudoscorpiones and Acari share a long preoral food canal. Recent studies (Dunlop, 2000) consider this structure homologous for the three groups and morphologically derived from the **epistome and labrum** (epistomo-labral plate). To recognize this structure as homologous, a detailed comparative anatomical and morphological study of the mouth parts is needed. Thus, the objective of this study is a detailed description of the mouthparts of the camel spiders using histology, modern scanning and 3D reconstruction techniques, contributing to a comparative microscopic anatomical study of the mouth region of pseudoscorpions and ticks.

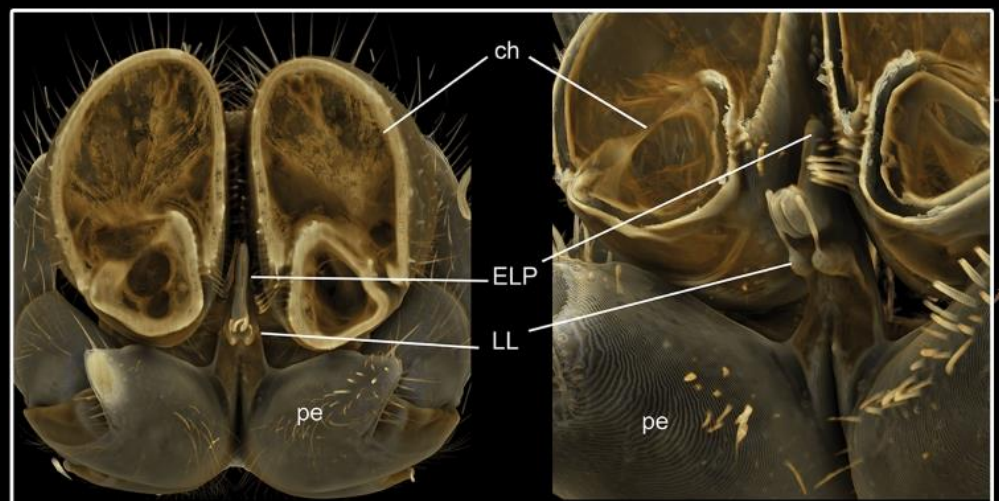


Fig. 1: 3D reconstruction of the camel spider mouth parts based on the micro-CT scans. ch - chelicerae; pe- pedipalpal element; ELP - epistomo-labral plate; LL - lateral lips.

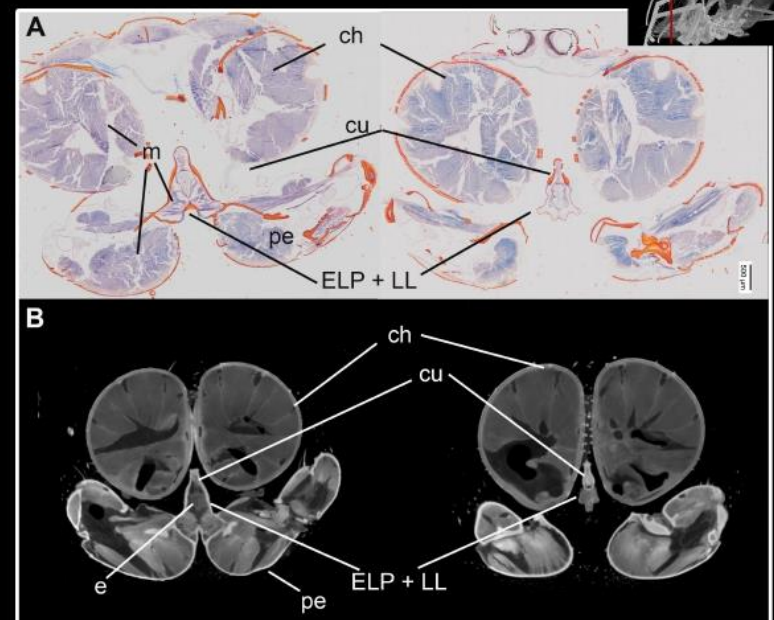


Fig. 2: Cross section of a camel spider (*G.granti*) A: Histology B: Micro-CT scans. ch - chelicerae; cu - cuticle; e - esophagus; m - muscles; ELP + LL - epistomo-labral plate + lateral lips; pe - pedipalpal element.

Fig. 3: Folding of a cuticle. ; pec - pedipalpal cuticle

Conclusion

The preoral food canal of Solifugae consists of a cuticular structures projecting anteriorly between the two segmented chelicerae, covering the mouth opening dorsally. Below the preoral food canal is a pair of lateral lips. The mouth parts of Solifugae are formed exclusively **from the basal articles of the pedipalps** - the pedipalp cuticle folds upwards extending in the anterior – posterior direction and fusing medially with its counterpart from the outside to form the epistomo labral plate. A homology with the mouthparts of ticks and pseudoscorpiones can be excluded.

Acknowledgements: I would like to thank Prof. Matthias Starck for giving me the opportunity to conduct this project as well as Dr. Joachim Haug for supporting the poster creation process. Furthermore, I would like to thank the EES Masters program of the LMU and my co-students for organizing this conference.

Ludwigs-Maximilians-University

How would you house a blue crane?

Annika Neuhaus

Since centuries, deflighting techniques like wing trimming have been used to prevent birds from escaping and making handling easier. However, a serious debate about animal welfare considerations ensued. This demand can get problematic as zoological institutions often simply can not afford big aviaries and, as shown here, aviaries are not automatically always the best solution. In this study a pair of blue cranes in the zoo Hellabrunn were exemplarily observed for 100 hours to investigate their spatial and active behavior. Thereby, I wanted to unfold the various aspects decisionmakers and zookeepers should keep in mind, when choosing the style of the enclosure and the method that is most appropriate for handling individual big birds.

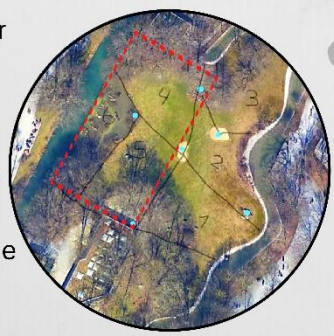
The financial aspect
Often, big aviaries are simply too costly. Due to this, as well as technical issues (e.g. snowload) or monument protection, aviaries are often smaller than open-topped enclosures.

The stress imposed by wing-trimming
In the Zoo Hellbrunn the male is trimmed biannually, the wings of the female crane are pinioned.

The enrichment
The enclosure includes a stream and a meadow, both would be smaller in an aviary.

Case-by-case decision

The space a species needs
The blue cranes live in an open-topped enclosure (4050 m²) together with dama gazelles. It was subdivided into 6 sectors in order to quantify the time that is spend by the birds in each sector.



The Activity
The more active a species/individual is, the higher the risk will be in an aviary to get injured through running or flying against nets.

- up to 97% of observed time was spent in 45% of the enclosure (marked red) which indicates that a smaller enclosure could also be suffiecient.
- The blue cranes were rarely active which suggests a low risk of injury through aviaries
- The meadow and the stream were frequently visited. As this reflects the habitat of wild populations, it is clear that enrichment plays an important role in the animal-wellbeing

ANTS VS. TERMITES:

SHAPE analysis of functional head region in eusocial insects

Morgan Oberweiser, Joachim T. Haug
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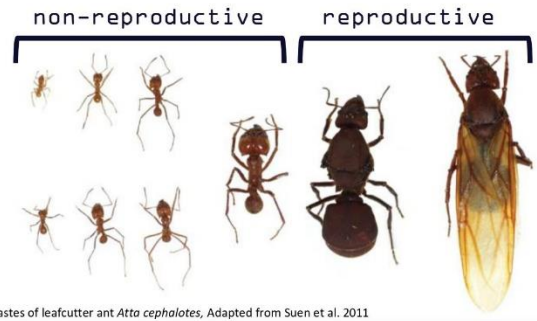
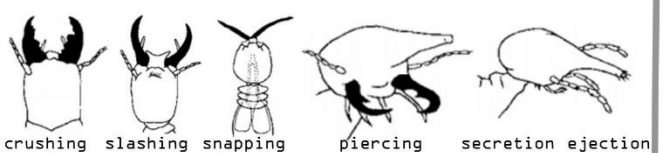
BACKGROUND

One defining feature of eusocial animals is reproductive division of labor. In many "advanced" eusocial insects, reproductive and non-reproductive individuals often develop **morphological differentiation**, sorting them into **"castes"**



Castes of leafcutter ant *Atta cephalotes*, Adapted from Suen et al. 2011

It is also common for **intra-caste diversity** to develop in cases where many different ecological functions are fulfilled by one caste. For example: mandible modification in termite soldiers:

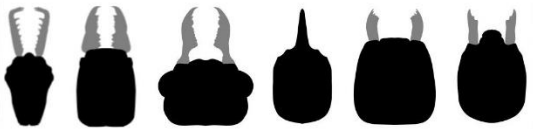


Adapted from Prestwich 1984

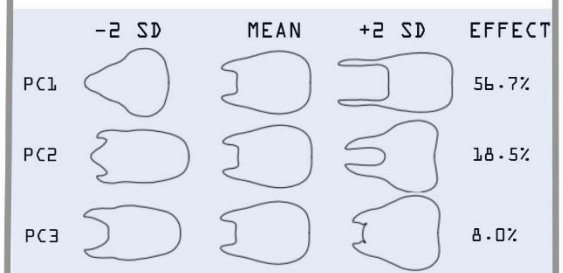
Ants and termites are compared because though they are **NOT closely related**, they serve similar ecological functions and have **evolved eusociality convergently**

METHODS

- Functional head region drawn from virtual specimens (published material) and specimens borrowed from ZSM and imaged



- SHAPE analysis quantifies shape using Elliptic Fourier descriptors

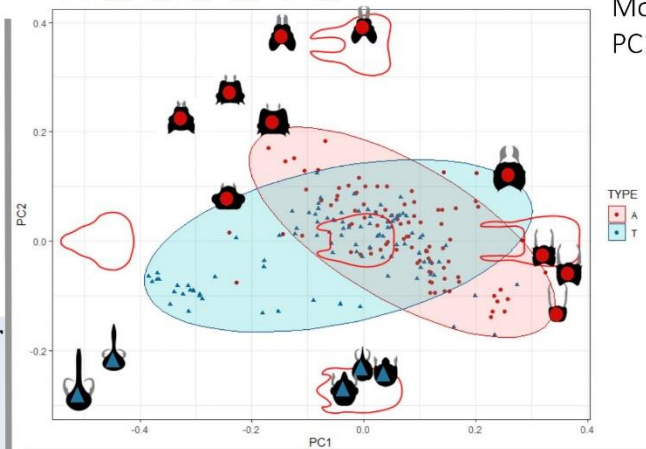


Principal component analysis showing **scope of morphological diversity in head shape in combined set of ants and termites**. Effect size denotes how much of the overall morphological diversity is explained by the equivalent PC.

ACKNOWLEDGEMENTS

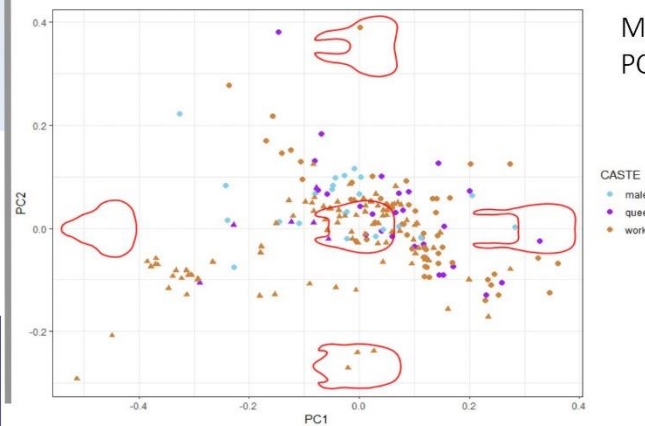
- Lars Hendrich, ZSM
- Peter Schächinger, Hari Tsivlin, Snata Chakraborty
- Florian Braig

RESULTS



Morphospace plot 1: PC1 x PC2 by **group**

- Ants and termites have significantly different head shapes
- Weight center of both groups is very similar, but variation spreads in different direction
- Termites largely occupy the bottom left corner, where the nasus is found



Morphospace plot 2: PC1 x PC2 by **caste**

- Castes do NOT have significantly different head shapes
- Variation is greatest in worker caste
- Males and queens tend to occupy similar area, indicating more conserved head shape

How does habitat quality affect behaviour in birds?

José Antonio Borrero, Prof. Dr. Niels Dingemanse,
Dr. Benedikt Holtmann, Irene Gaona-Gordillo

Ludwig Maximilian Universty Munich, Department of Biology II, Behavioural Ecology

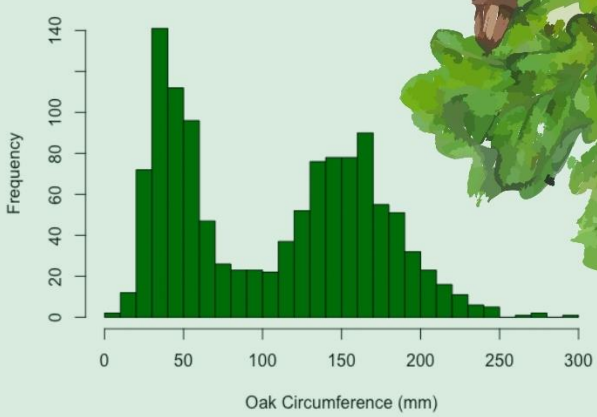
Introduction

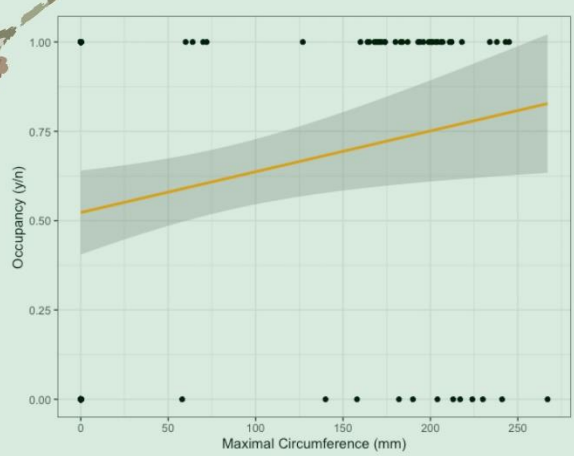
- Great and Blue tits (*Parus major and Cyanistes caeruleus)*
- Specific habitat requirements
- Vegetation fundamental for habitat quality
- Oak-trees *(Quercus* sp.) rich in caterpillars
- Test the role of habitat quality in nest box occupancy
- Effect habitat quality personality-related differences within- & between species
- How this affects fitness

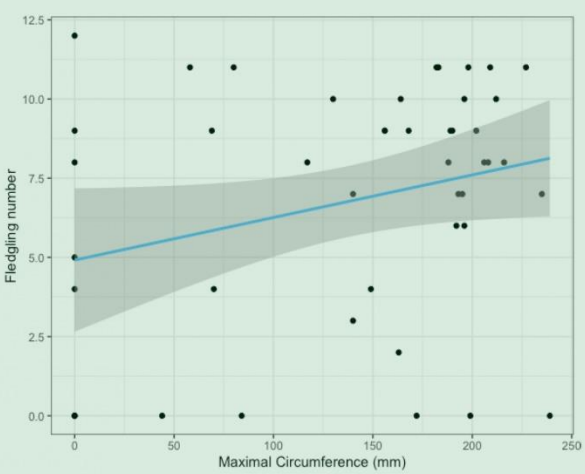
Methods

1. Data collection:
   Lay date, clutch size, fledgling number, etc.
2. Exploratory tests
3. Habitat quality:
   15 m radius
   Oak number
   Oak circumference

Results & Discussion







- Positive correlation between nest box occupancy and maximal oak circumference
- Clutch size differences between species
- Positive effect of maximal oak size on fledgling number
- No correlation between exploration behavior & habitat quality
- No effect of maximal oak circumference on laying date or clutch size

Aknowledgements: I am thankful to Prof. Dr. Niels Dingemanse, Dr. Benedikt Holtman, Irene Gaona-Gordillo, Alexander Hutfluss and Nicole Miller from the Behavioural Ecology at the LMU for their support with field work, experimental design and data analysis.

Geometric morphometric analysis of potential hybridisation between cave bears (*Ursus spelaeus*) and brown bears (*Ursus arctos*) in the late Pleistocene.

Stefan Dehos[1,3], Anneke H. van Heteren[1,2,3]

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Introduction:

The brown bear (*Ursus arctos*) is one of the closest living relatives to the extinct Late Pleistocene cave bear (*Ursus spelaeus*) [1]. *Ursus spelaeus* is considered to be a herbivore and *Ursus arctos* is an omnivore [2]. This results in differences in their craniodental morphology. Despite these differences geneflow between these two species has occurred [3]. According to a preliminary analysis late Pleistocene bear skull fragments found in caves in Belgium show intermediate phenotypes between *U. arctos* and *U. spelaeus*. To analyse a potential hybridisation between these two species a 3D geometric morphometric analysis was performed.

Methods and Material:

- in total eight skull fragments were analysed
- found in Belgian caves sites
- fragments digitised using a CT scan
- a 3D model was created
- the potential hybrids are compared to existing landmark data of *U. spelaeus* and *U. arctos* [2,4] (Fig 1).
- generalised Procrustes superimposition was used
- a Principal components analysis was issued (Fig. 2).

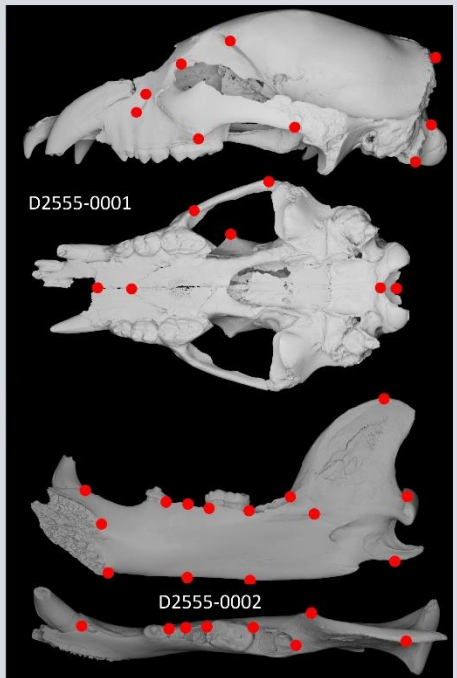


Figure 1: landmark placement

Results and Discussion:

- some specimens seem to be in an intermediate space between the two reference groups
- especially the fragments D2555-0001 and D2555-0002.
- this points to a hybrid phenotype in these fragments.
- intermediate phenotype related to angular and coronoid process and the mandibular condyle
- however, important parts for discrimination are missing in most fragments.
- potential hybridisation between *U. arctos* and *U. spelaeus* in the late Pleistocene.

Principal components analysis:

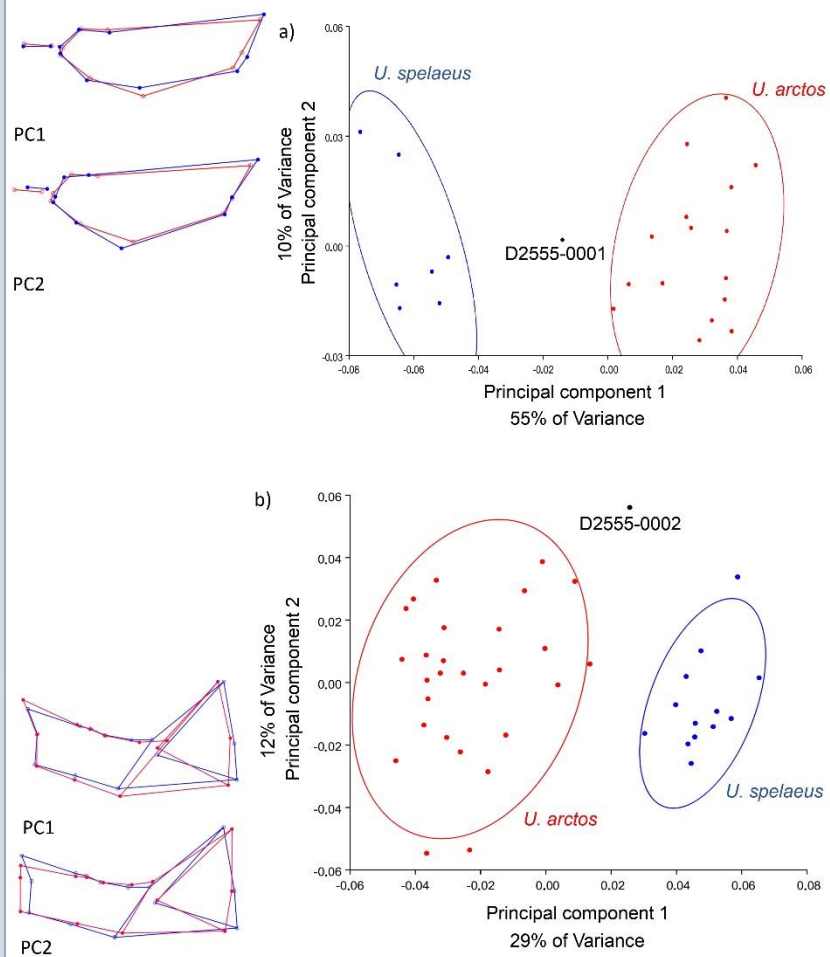


Figure 2: Principal components analysis and the shape changes along the Principal components

References:

[1] Hänni, C.; Laudet, V.; Stehelin, D.; Taberlet, P. (1994): Tracking the origins of the cave bear (*Ursus spelaeus*) by mitochondrial DNA sequencing. Proceedings of the National Academy of Sciences 91 (25), S. 12336. DOI: 10.1073/pnas.91.25.12336.

[2] van Heteren, Anneke H.; MacLarnon, Ann; Soligo, Christophe; Rae, Todd C. (2014): Functional morphology of the cave bear (*Ursus spelaeus*) cranium: a three-dimensional geometric morphometric analysis. Quaternary International 339-340, S. 209– 216. DOI: 10.1016/j.quaint.2013.10.056.

[3] Barlow, Axel; Cahill, James A.; Hartmann, Stefanie; Theunert, Christoph; Xenikoudakis, Georgios; Fortes, Gloria G. et al. (2018): Partial genomic survival of cave bears in living brown bears. Nature ecology & evolution 2 (10), S. 1563–1570.

[4] van Heteren, Anneke H.; MacLarnon, Ann; Soligo, Christophe; Rae, Todd C. (2016): Functional morphology of the cave bear (*Ursus spelaeus*) mandible: a 3D geometric morphometric analysis. Organisms Diversity & Evolution 16 (1), S. 299–314. DOI: 10.1007/s13127-015-0238-2.

Ludwigs-Maximilians-University

Coronavirus prevalence in bats

Rosalie Krause – rosalie.krause@campus.lmu.de – Supervisor: Dr. Vera Warmuth

Introduction

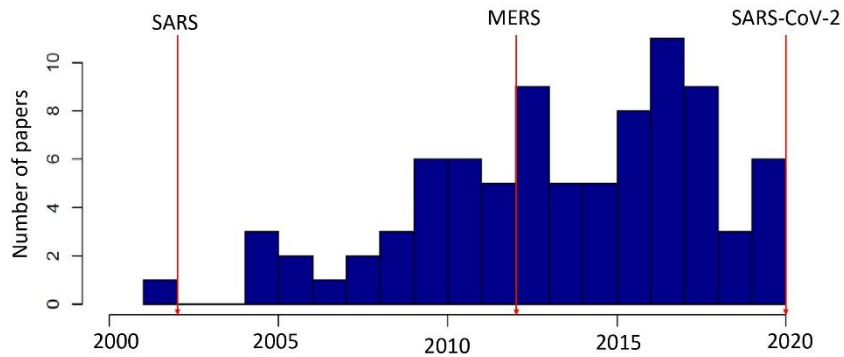
Old approaches: Presence of Alphacoronaviruses/Betacoronaviruses in bats described for a great variety of bat species

New approach: Different ecological and sampling specific categories influence the prevalence of corona viruses in bats

Factors: Geographical region, anthropogenic activities on bat habitats, stress levels, feeding guild, phylogenetic relationship

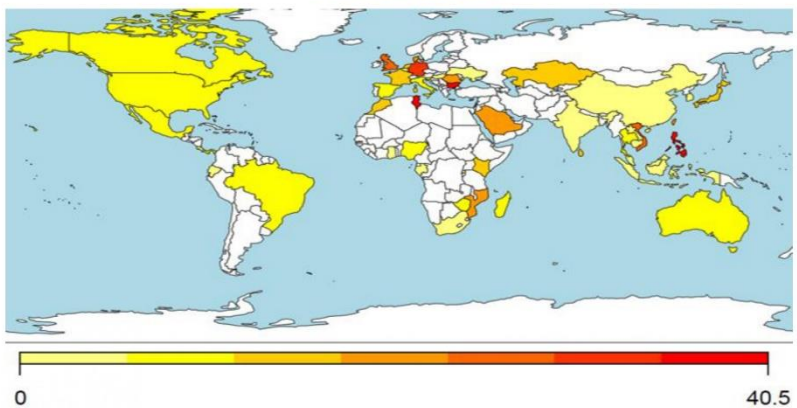
Aim of the project: collect data about the exact sampling process from already published papers and to implement this information in form of precise subcategories into a big database.

Database



Number of papers published per year included in the database. Red arrows indicate serve outbreaks of coronavirus induced infections

Prevalence



Prevalence in percentage for coronaviruses in bats in each country for which samples were taken

Problems

- Poor quality standard of provided data
- Minimal information about sampling circumstances given
- Renewed phylogeny of coronaviruses

Outlook

Done so far: Implementation of databank as first step of meta-analysis

To be done:

- Finer resolution of geographical categories
- Fine disentanglement of human influence on bat habitats

EES Conference

"The interface between primary and secondary metabolism in the acclimation to cold and constant light in *Arabidopsis*"

Roberto Rebollo[1*], Thomas Nägele

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Introduction

Plant metabolism

The **metabolism of plants** often maximises **energy** gain, while simultaneously dealing with the **environmental conditions.**

Plants **share a central metabolism**, and additionally, species-specific **secondary metabolites.**

Study system

Mutated lines of *A. thaliana*:

Genotypes deficient in:

bam3 – breaks down starch
pgm – synthesis of starch
inv4 – breaks sucrose
cinv – breaks sucrose
chs – required for flavonoid synthesis
f3h – required for anthocyanin synthesis

(Not *Arabidopsis thaliana*)

Acclimation

Cold conditions threaten to freeze tissues, while the influx of light can produce more reactive oxygen species (ROS). Plants tend to accumulate carbohydrates, anthocyanins and organic acids in response.

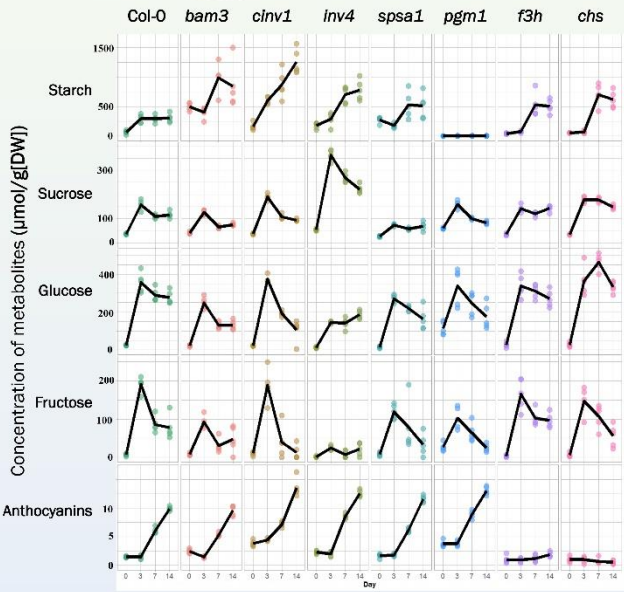
Constant light also indices a higher production of ROS, with plants accumulating more carbohydrates.

Treatment

Simultaneous **cold** (4°C) and **constant light**

Quantification of primary and secondary metabolites at **0, 3, 7 and 14 days**

Results and discussion



Primary and secondary metabolites

- **Starch accumulates and stabilises** from day 3 in Col-0. Strong genotype effect.
- **Acute response** in the accumulation of **soluble sugars** (sucrose, glucose and fructose), which increase sharply by day 3, but then decrease and stabilise.
- **Anthocyanins accumulate steadily** from day 3 until day 14. Some genotypes (*pgm1, cinv1*) show a higher constitutive level.

n ≥ 4 per time point per genotype

Manipulating plant functional traits to control *Senecio aquaticus* in wet grasslands

Maysan Nashashibi, Dr. Leonardo H. Teixeira , **Prof. Dr.** Johannes Kollmann , **Prof. Dr.** Herwig Stibor

Chair of Restoration Ecology, Technical University of Munich

INTRODUCTION

Native invaders are considered widely spreading, ecological challenging and economical consuming type of invasions that is found worldwide and in German grasslands. One example is *Senecio aquaticus*, which is considered a life-threating species to livestock and cattle, due to its containment of the pyrrolizidine alkaloids. During the last two decades, scientists and researchers have been trying to investigate different methods and principles that can lead to the suppression of ***Senecio aquaticus.***

The aim of this study:

To evaluate which traits in a plant community should be constrained and/or diversified to find the species composition with the strongest impact to suppress *S. aquaticus* abundance.

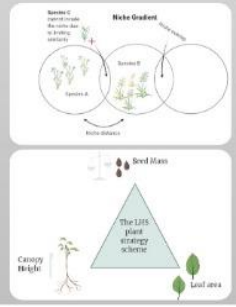
In this research, we are investigating the effect of different seed mixture, which uses functional diversity and limiting similarity to obstruct species communities with an effect on the *S. aquaticus* performance and biomass.

HYPOTHESIS

The community functional diversity is inversely proportional to the *S. aquaticus* biomass yield due to the limiting similarity and resources depletion. Consequently, larger functional diversity is predicted to be the most competitive factor in *S. aquaticus* suppression.

STUDY DESIGN

- Laughlin (et al., 2018) in forming plant communities.
- tested for the invasion resistance of restored grasslands plant communities.
- 36 pre-alpine grasslands species within 15 families.



Seed mixtures preparation

Constraining trait means the community like the *S.aquaticus*

Experimental Setup

- 90 plastic trays.
- *S. Aquaticus germination* is between 10-20 ° C

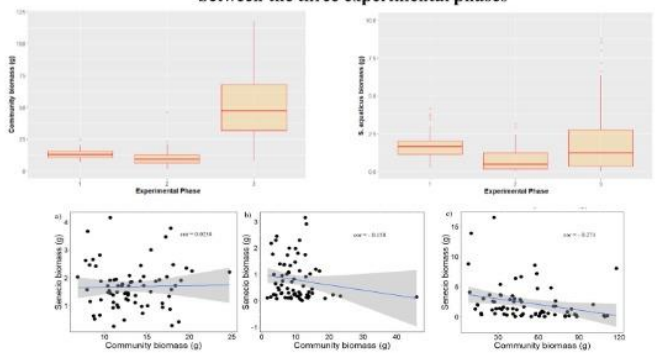
Data Collection

Phase 3 after 47 weeks

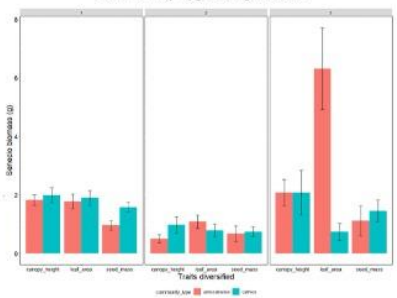
Calculations and Statistical Analysis

RESULTS

Comparing Community/ *S.aquaticus* biomass between the three experimental phases



Traits constrained, traits diversified and community type comparisons



SUMMARY AND DISCUSSION

- we investigated the abundance and growth of the native plant community and *S. aquaticus* after each of the three mowing phases.
- The first phase had the highest *S. aquaticus* biomass due to the plant preferences of humid over dry soil.
- Twice a year cutting can reduce the presence of the species.
- vegetation biomass and seed productions are usually affected by below-ground competition.
- ACHLA and ASMLA treatments during the third phase shows significant increase , be explained by the stronger effect of the interspecific competition over the intraspecific in our plant community.
- **We revealed that the native invasive species *S. aquaticus* could be inhibited by reducing resource availability.**

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