Natural history collections are the libraries of life and a major resource for biodiversity studies, providing morphological characters and information about species distribution. As many of the currently recognized animal species have never been recollected and are known only from the descriptive specimens (types), natural history collections are crucial for the understating of evolutionary history of life on our planet – especially in the context of the present biodiversity crisis. Furthermore, the majority of the new species currently being described are based on museum specimens, which were collected several years ago.

For decades the genetic resource preserved in museum specimens remained mostly uninvestigated due to lack of specific protocols of DNA extraction and sequencing. Recent advances in molecular biology finally changed this situation. Up to now, the museum sequencing techniques have been employed in a variety of biological studies (e.g. human evolution). However, the contributions regarding beetle systematics are scarce, while the available methodology still requires testing.

This project aims to reconstruct the phylogenetic relations of the stridulatory darkling beetles (Platynotini) – a morphologically diverse beetle tribe of nearly 600 species classified in 75 genera. The goal will be achieved primarily based on the next-generation sequencing of museum specimens, which was selected as the most time- and cost-effective approach due to the difficulties of collecting platynotoid species caused by geographical (wide distribution), political (inaccessible areas), environmental (habitat degradation), and biological factors. Based on this phylogenetic dataset more specific evolutionary and biogeographic problems will be addressed.

Representatives of the targeted tribe are disjunctly distributed throughout Sub-Saharan Africa, North and South America, and the Indomalayan area, with no genera and species currently shared between regions. As the majority of the tribal representatives are wingless it creates an interesting biogeographic scenario, which once investigated – in the phylogenetic context – will provide unique insights on the history of our planet (e.g., past climate change, origin and evolution of plant formations). Furthermore, stridulatory darkling beetles are an interesting model for biology due to ovoviviparity, which was reported for some of its representatives – especially the Malagasy species. This mode of reproduction, where eggs develop within the mother until hatching, is often viewed as a preadaptation to viviparity and is extremely rare among beetles. A robust phylogeny will be used to investigate the morphological and biological (habitat selection) drivers for ovoviviparity within the tribe.

In order to test the limits of the museum sequencing and provide insights to the methodological aspect of this approach, additional specific projects addressing major gaps in our knowledge of stridulatory darling beetles across different classification levels were formulated. Realization of those projects will help to further illuminate the phylogenetic relations among the tribe.

As the correlation between quality of DNA yield and time which has passed since the collection of a particular specimen is not direct, assessment of the phylogenetic potential of a given collection is challenging without conducting a targeted study. Up to now, no such attempts were taken for the Polish historical-entomological collections. The current project will primarily be based on the specimens preserved at the Museum and Institute of Zoology of the Polish Academy of Sciences, while the analyzed individuals will originate from collections created by specifically selected entomologists, i.e. Hans Gebien (1874–1947), Witold Eichler (1874–1960), Szymon Tenenbaum (1892–1941), Carl Koch (1904–1970), Zoltán Kaszab (1915–1986), and Sebastian Endrödy-Younga (1934–1999). Because all of the above-mentioned researchers gathered a variety of beetle families from different parts of the world, the results of this investigation will impact many future phylogenetic projects. Furthermore, due to the historical value and general public interest in Tenenbaum's entomological collection (Book: The Zookeeper's Wife), the outcome of this study might generate publicity. The experience gathered during the realization of this project will be used to implement protocols for museum sequencing in the largest Polish zoological collection.

The research objectives of this proposal are intertwined with its mentoring objectives, as a PhD student will be actively participating in all aspects of the project, thereby positioning him/her as interdisciplinary scientist with skills cutting across boundaries from taxonomy and systematics to biogeography.