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# Lost in the dark: why we still don't understand parasitoid decline and extinction

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**Abstract:** Insect decline is a matter of serious concern to global biodiversity, yet most research is focused on a few well-studied groups. A significant portion of flying insects consists of the understudied parasitoid wasps, which are extremely high in species diversity and provide crucial ecosystem services, most notably regulation of host insect populations. For reasons that include small body size and scant diagnostic resources, these wasps are difficult to study at even the most basic level and are often referred to as "dark taxa." In addition to the taxonomic impediment, the lack of accurate and comprehensive knowledge of host-parasitoid associations, the "ecological impediment," is a critical barrier to monitoring parasitoid decline or extinction. In Germany, where flying insect biomass has decreased by more than 75% since the 1980s, the apparent disappearance of the giant platygastrid wasp, *Isocybus grandis*, exemplifies the manifold challenges of parasitoid conservation. The complexities of assessing the status of this species are aired as a case study. The taxonomic impediment, the ecological impediment, and their interrelationships are discussed in the context of lost species and dark extinctions.

**Keywords:** dark extinction, dark taxa, gall midges, Germany, insect decline, shadow diversity

**Conservation statement:** Parasitoids comprise an entire trophic level whose conservation status remains almost entirely unknown. Despite their critical roles in ecosystems and their high abundance and diversity, the decline of parasitoid wasps goes largely unnoticed. For example, in Germany, the giant platygastrid wasp *Isocybus grandis* has not been seen since the mid-20th century. However, its apparent disappearance is difficult to confirm due to a lack of fundamental knowledge. Taxonomic and ecological impediments contribute to this. Increased attention and the use of integrative approaches for dark taxa by taxonomists, but also ecologists and conservationists, is urgently required. Documenting these dark declines and dark extinctions requires continuous, systematic collection efforts, study of preserved historical specimens, targeted search for potentially lost species, and taxonomists trained for the inclusion of dark taxa in insect monitoring.

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**Zusammenfassung:** Das Insektensterben ist ein ernstes Problem für den Naturschutz, doch konzentriert sich der Großteil der Forschung auf wenige, gut untersuchte Gruppen. Einen bedeutenden Teil der Fluginsekten machen die wenig erforschten parasitoiden Wespen aus, die eine extrem hohe Artenvielfalt aufweisen und entscheidende Ökosystemleistungen erbringen, insbesondere in der Regulierung der Populationen ihrer Wirtsinsekten. Aufgrund von Faktoren wie ihrer geringen Körpergröße und der begrenzten diagnostischen Möglichkeiten sind diese Wespen wissenschaftlich kaum zugänglich und werden oft als „Dark Taxa" bezeichnet. Neben dem taxonomischen Hindernis stellt der Mangel an präzisen und umfangreichen Kenntnissen über Wirt-Parasitoid-Beziehungen, das „ökologische Hindernis", ein entscheidendes Hemmnis für die Erfassung des Rückgangs oder Aussterbens von Parasitoiden dar. In Deutschland, wo die Biomasse fliegender Insekten seit den 1980er Jahren um mehr als 75 % zurückgegangen ist, veranschaulicht das scheinbare Verschwinden der Riesen-Platygastride *Isocybus grandis* die vielfältigen Herausforderungen des Schutzes von Parasitoiden. Die Komplexität der Beurteilung des Status dieser Art wird als Fallstudie genauer beleuchtet. Das taxonomische Hindernis, das ökologische Hindernis und ihre Wechselbeziehungen werden im Zusammenhang mit verlorenen Arten und „dunklen Aussterben" erörtert.

**Schlüsselwörter:** Dunkle Aussterben, Dark Taxa, Gallmücken, Deutschland, Insektensterben, Schattenvielfalt

**Stellungnahme zum Naturschutz:** Parasitoide umfassen eine gesamte trophische Ebene, deren Gefährdungsstatus fast gänzlich unbekannt ist. Obwohl sie eine zentrale Rolle in den Ökosystemen spielen, zahlreich und sehr artenreich sind, bleibt der Rückgang parasitoider Wespen weitgehend unbemerkt. So wurde beispielsweise die große Riesen-Platygastride *Isocybus grandis* seit Mitte des 20. Jahrhunderts nicht mehr in Deutschland beobachtet. Ihr scheinbares Verschwinden lässt sich jedoch aufgrund fehlender Grundlagenkenntnisse nur schwer bestätigen. Dazu tragen taxonomische und ökologische Hindernisse bei. Erhöhte Aufmerksamkeit und der Einsatz integrativer Ansätze für "Dark Taxa" seitens Taxonom*innen, aber auch von Ökolog*innen und Naturschützer*innen sind dringend erforderlich. Die Dokumentation dieser verborgenen Artenrückgänge und Aussterbeereignisse erfordert kontinuierliche, systematische Sammelinitiativen, die Untersuchung historischer Präparate, die gezielte Suche nach potenziell verlorenen Arten und ausgebildete Taxonom*innen für die Einbeziehung von Dark Taxa in das Insektenmonitoring.

## INTRODUCTION

Insect decline has attracted much attention in recent years, largely inspired by the German "Krefeld study" which reported the loss of more than 75% of flying insect biomass since the 1980s (Hallmann et al. 2017). In Germany, as elsewhere, a significant portion of flying insects are parasitoid wasps (Haas-Renninger et al. 2024; Srivathsan et al. 2023). Parasitoid wasps lay their eggs in or on another individual animal, consuming it over the course of their larval development and killing the host before emerging as an adult. The parasitoid life history is distinct from that of parasites, which do not obligately kill the host, and predators, which consume more than one prey item during their lifetimes (Burke and Sharanowski 2024).

Comprising more than 80 families in the suborder Apocrita (Hymenoptera), parasitoid wasps represent the vast majority of hymenopteran diversity, with estimates of approximately half a million to a million species worldwide (Blaimer et al. 2023; Forbes et al. 2018). Most of these parasitoid species are considered to be "dark taxa" which at present cannot be reliably identified by morphological or molecular means (Awad et al. 2025; Hausmann et al. 2020).

Although most parasitoid species are undiscovered or poorly known, all available evidence supports their critical role as regulators of arthropod populations (Borges et al. 2025). Most insect species host at least one parasitoid species, and often more (Forbes et al. 2018). All stages of insect development, from egg to adult, are susceptible to parasitoid attack. Parasitoid wasps can also attack spiders, ticks, or nematodes (Burke and Sharanowski 2024). Herbivorous insects are especially prone to parasitoid wasps, probably due to the herbivorous origins of Hymenoptera and the associated ability to exploit plant cues (Blaimer et al. 2023; Godfray 1994). Parasitoid wasps are thus essential to plant fitness in natural as well as agricultural ecosystems (Smallegange et al. 2008).

## Taxonomic impediments in dark taxa

Many taxa are dark because their species are largely undescribed. However, in some cases, particularly in Europe, the problem is rather that the described fauna are not sufficiently diagnosed ("superficial descriptions" *sensu* Meier et al. 2022). As a result, it is often impossible to determine whether any given specimen belongs to a named species or is completely new to science. In many cases, this also renders species-level occurrence records and other data associated with literature records nearly useless, as the species concept will vary between observers.

Resolving this taxonomic impediment requires examination of the type specimens of all named species in the genus or species-group. Such revisionary work is time-consuming, often requires expensive travel to multiple institutions, and is typically not highly valued by funding agencies (Liu 2024). To further complicate matters, historical type material in Europe has frequently been lost via inadequate record keeping, or destroyed due to war, fire, or neglect (Awad et al. 2023, 2024; Graham 1988).

There may be some justification for ignoring superficial species descriptions when no meaningful data is attached to the name. However, for parasitoid species, even when a description itself is useless for identification, the original author, or subsequent researchers, may link a scientific name to host associations or other ecological observations. Such data are absolutely essential to evaluating conservation status and extinction risk based on host and habitat needs.

## Dark declines and extinctions

Although declines and extinctions almost certainly occur among dark taxa, scientific evidence for such phenomena is inherently difficult to obtain (Turton-Hughes et al. 2024). The majority of insect decline research has focused on a few charismatic taxa, especially pollinators, while neglecting most others (Halsch et al. 2025). Only two countries, Sweden and Finland, include any parasitoid wasp species on their national Red Lists. These belong to large-bodied, relatively well-studied groups with known host associations (mainly "Darwin wasps" in the family Ichneumonidae), allowing for effective monitoring and understanding of habitat needs. Even so, many of the listed species are categorized as Data Deficient, and the majority of Scandinavian parasitoid biodiversity has not been evaluated at all (Hyvärinen et al. 2019; SLU Artdatabanken 2020). Likewise, the International Union for Conservation of Nature (IUCN) Red List includes 35 parasitoid wasp species, 27 of which are Data Deficient. The eight exceptions are endemic island species whose conservation status is inferred from the overall status of the island habitat (IUCN 2025).

Scientific publications documenting the extinction or decline of parasitoid wasp species are correspondingly rare. To our knowledge, the only such study is that of Abe et al. (2023), concerning two parasitoids of a gall wasp reared from *Rosa hirtula* (Regel) Nakai, an endemic Japanese rose threatened with extinction. The premise that these parasitoids are at risk of extinction depends on the assumption of host specificity, and a consequent inability to exploit other, less threatened host species. Although it is entirely plausible that one or both parasitoid species are host specific, proving it requires extensive study of multiple potential hosts.

## An ecological impediment to understanding parasitoid decline

This lack of accurate and comprehensive knowledge of host–parasitoid associations constitutes an ecological impediment to holistic insect conservation. Most parasitoid wasps lack any documentation of host associations (Miller et al. 2021). Even for those species with recorded hosts, the full host repertoire, including various degrees of environmental plasticity, remains largely unknown (Shaw 1994; Shaw and Hochberg 2001).

The taxonomic impediment in parasitoid wasps and other dark taxa is a serious challenge, but the ecological impediment is even more difficult to overcome. Taxonomic problems can often be addressed through an integrative approach, relying on existing collections and available tools, complemented with new methods and technologies that facilitate taxonomic progress (Meier et al. 2024). The limiting factors here are funding, time, and expertise (Engel et al. 2021). However, ecological problems require larger quantities of harder-to-obtain data. Fieldwork, direct observations, and systematic rearing efforts are required for obtaining accurate information on the host repertoire of a parasitoid. Although some molecular techniques have been tested for obtaining host–parasitoid associations, these are expensive and have not yet been applied on broad scales (Šigut et al. 2017).

Of course, the two impediments are closely interlinked (Fig. 1). First, species-level identifications of both host and parasitoid are required to understand patterns of host specificity (Awad et al. 2025). Unreliable identifications in literature, databases, and collections can seriously obscure the true relationships in these multitrophic systems (Noyes 1994; Shaw 1994, 2023). Second, the host repertoire, including the level of specialization of a parasitoid, represents a highly important type of data in integrative species concepts (Smith et al. 2008) and can also play a key role in connecting existing species names with new types of data, such as DNA barcodes. With this, both impediments exacerbate each other: the quality of ecological data can either confuse or clarify taxon concepts,

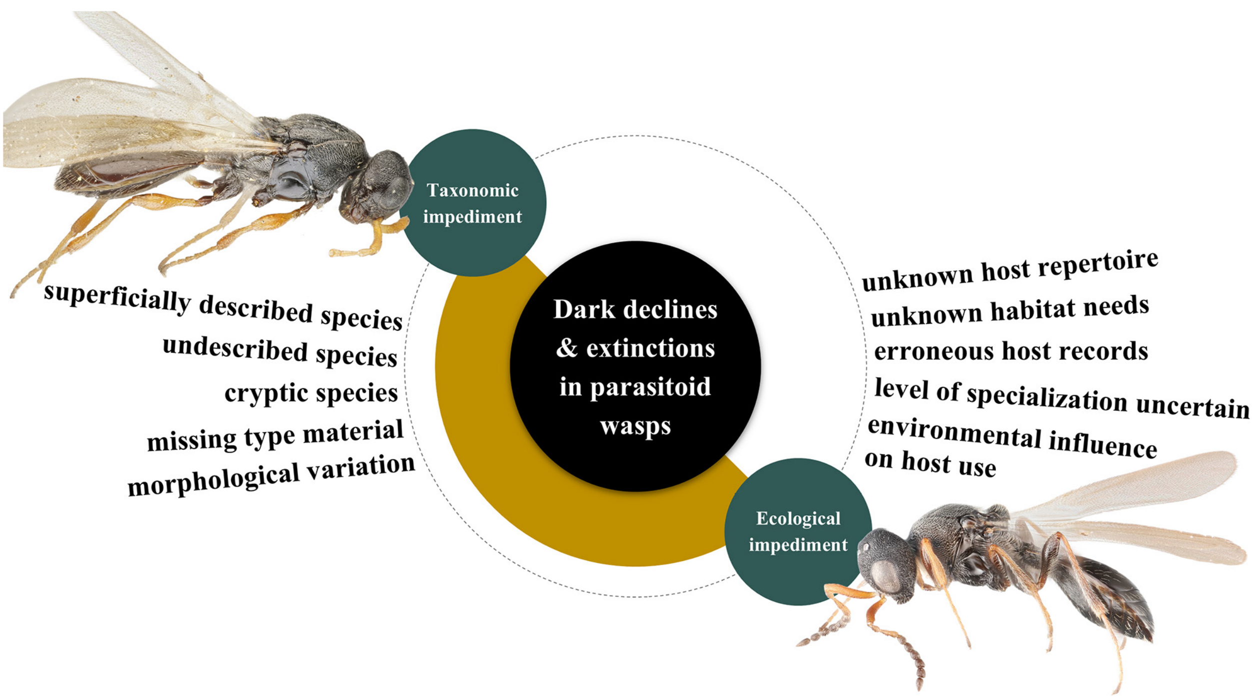


**Figure 1.** Taxonomic and ecological impediments to understanding parasitoid decline and extinction. Image credit, J. Awad.

while the taxonomic impediment hinders the collection of accurate ecological data, contributing directly to the ecological impediment.

The case of *Isocybus grandis* (Nees, 1834) (Hymenoptera: Platygastridae: Platygastrinae), a putatively lost species in Germany, exemplifies both the taxonomic and ecological impediments to understanding parasitoid declines and extinctions. At present, these impediments prevent the establishment of conclusive evidence for decline or extinction. However, the lost species concept, here defined as "not detected in the wild in 10 or more years" (Long and Rodríguez 2022), provides an appropriate framework for evaluating the apparent disappearance of this and other dark taxa. Within this framework, the length of time since the species was last seen, and the amount of search effort expended, are both presumed to be positively correlated with the likelihood of extinction.

## Natural history

The giant platygastrid, *Isocybus grandis* (Fig. 2), was first described from Lower Franconia, Bavaria, Germany, in the early 19th century. The author, Nees von Esenbeck, collected a male in Mainstockheim on October 8, 1810, and a female near Grosslangheim on May 9, 1812. The female was caught in the glandular tentacle of a sundew plant, *Drosera rotundifolia* L., near a pond (Nees 1834).

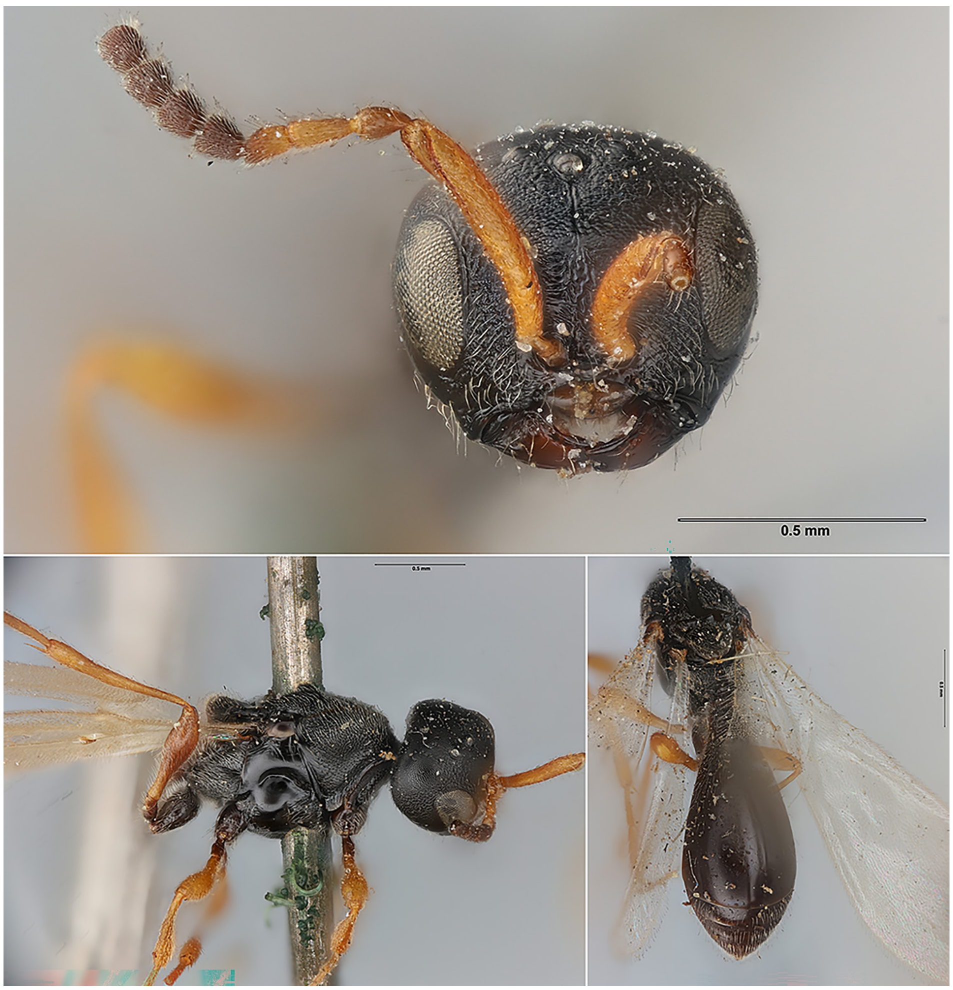


**Figure 2.** Original specimens of *Isocybus grandis*, Naturhistorisches Museum Wien. Presumably collected by Nees von Esenbeck, Germany, early 19th century. Scale bar = 0.5 mm. Images first published in Awad et al. (2023): copyright by J. Awad (CC BY 4.0): https://creativecommons.org/licenses/by/4.0/

All known species of Platygastrinae are obligate parasitoids of gall midges (Diptera: Cecidomyiidae) (Awad et al. 2025). The host repertoire of *I. grandis* is unknown. We suspect that all species of *Isocybus* parasitize gall midges in the genus *Planetella*, which specialize on sedges in the genus *Carex* (Ševčik et al. 2023). This supposition is based on four lines of circumstantial evidence, as follows.

First, members of the genus *Isocybus* are very large for Platygastridae (usually over 3 mm long), requiring an unusually large cecidomyiid host. Members of *Planetella* are among the largest gall midges, with some species reaching up to 10 mm long (Skuhravá and Skuhravý 2021).

Second, both *Isocybus* and *Planetella* are limited to temperate Europe and North America, an unusual distribution. Platygastridae and Cecidomyiidae typically have their highest diversity in the tropics (Austin et al. 2005; Gagné and Jaschhof 2021).

Third, most collections of *Isocybus* come from wetland areas, highly suitable habitat for many *Carex* species. For example, Nees von Esenbeck (1834) collected both specimens of *I. grandis* from damp areas. Other collections include 40 *Isocybus* specimens near the Venetian Lagoon, Italy, between 1944 and 1948; many more *Isocybus* from marshes in northern Europe in the late 1970s; and specimens swept from sedges near the shore of Lake Erie, Canada, in 1980.

Finally, two vouchered rearing records exist for *Isocybus* sp., both from *Planetella arenaria* on *Carex arenaria* (Bruun et al. 2024; Vlug 1995). An unvouchered rearing record, from the brassica pod midge *Dasineura brassicae*, is certainly a misidentification, as the midge only grows to 1.5 mm long and cannot physically accommodate a parasitoid nearly twice its size (Coutin and Riom 1970; Hausmann 2021).

## Systematics

The giant platygastrid, *Isocybus grandis* (Hymenoptera: Platygastridae: Platygastrinae), was originally described by Nees von Esenbeck (1834) as *Platygaster grandis*. It was then placed in *Isocybus* Förster (1856) by Dalla Torre (1898), after which it received minimal scientific attention.

The type material of *Isocybus grandis* was destroyed along with the majority of the Nees von Esenbeck collection, either discarded, damaged by mold, or destroyed by bombs (Graham 1988). However, the Naturhistorisches Museum Wien (NHMW, Vienna, Austria) houses four "original exemplars" of this species, which were evidently collected and identified by Nees von Esenbeck (Fig. 2). One of these was designated as the neotype by Awad et al. (2023).

*Isocybus grandis* is likely synonymous with *Platygaster ruficornis* (Latreille) *sensu* Westwood. The type specimen of *P. ruficornis* was lost for 182 years, only being rediscovered in 2022. In the meantime, the name *P. ruficornis* became attached to an entirely different genus of platygastrid wasps, *Platygaster sensu* Förster. Further details on this taxonomic quagmire, along with a proposed solution, are provided by Awad et al. (2024). Regardless, we here consider the type specimen of *P. ruficornis* to be an early example of *I. grandis.*

Although the species-level taxonomy of the genus *Isocybus* remains unresolved, our morphological concept of *I. grandis* includes a smooth mesopleuron and a head without a distinct medial excavation (Fig. 3). Partitioned DNA barcode data from the GBOL project suggest that these characters are stable at the species level (Puillandre et al. 2021). It is possible that multiple species have this combination of characters, but further resolution is not possible at present. We therefore apply a conservative interpretation, including all similar specimens as putatively conspecific.

An integrative taxonomic revision of European *Isocybus* is necessary to develop more reliable species diagnoses. Such a revision would require DNA barcoding of specimens from throughout Europe, which is hindered by the fact that *Isocybus* specimens are rarely collected. Comparison of molecular vouchers to name-bearing specimens is further complicated by the problem of lost types: 13 of the 26 described European species have no known type material (Vlug 1995).

## Geography

For many years, *I. grandis* was the only member of its genus reported from Germany (Dathe et al. 2001). Besides the original specimens from Lower Franconia in 1810 and 1812, we are aware of conspecific specimens collected near Stuttgart ca. 1840 and Brandenburg in 1925. Similar specimens (putatively conspecific) have also been collected from Austria (ca. 1865, 1946, 1948); Czechia (1976); England (2009); France (ca. 1804); the Netherlands (1926, 2003); Scotland (1982–1993); and Sweden (1868 and 1870) (Fig. 4).

Additional records from the literature are questionable due to the frequency of misidentification. Examination of voucher specimens is required for confirmation.

# STATUS

## Evidence

We consider *Isocybus grandis* to be a lost species. To our knowledge, no conspecific specimens have been found in Germany since 1925. Congeneric specimens have been collected in Germany, but they appear to be different spe-

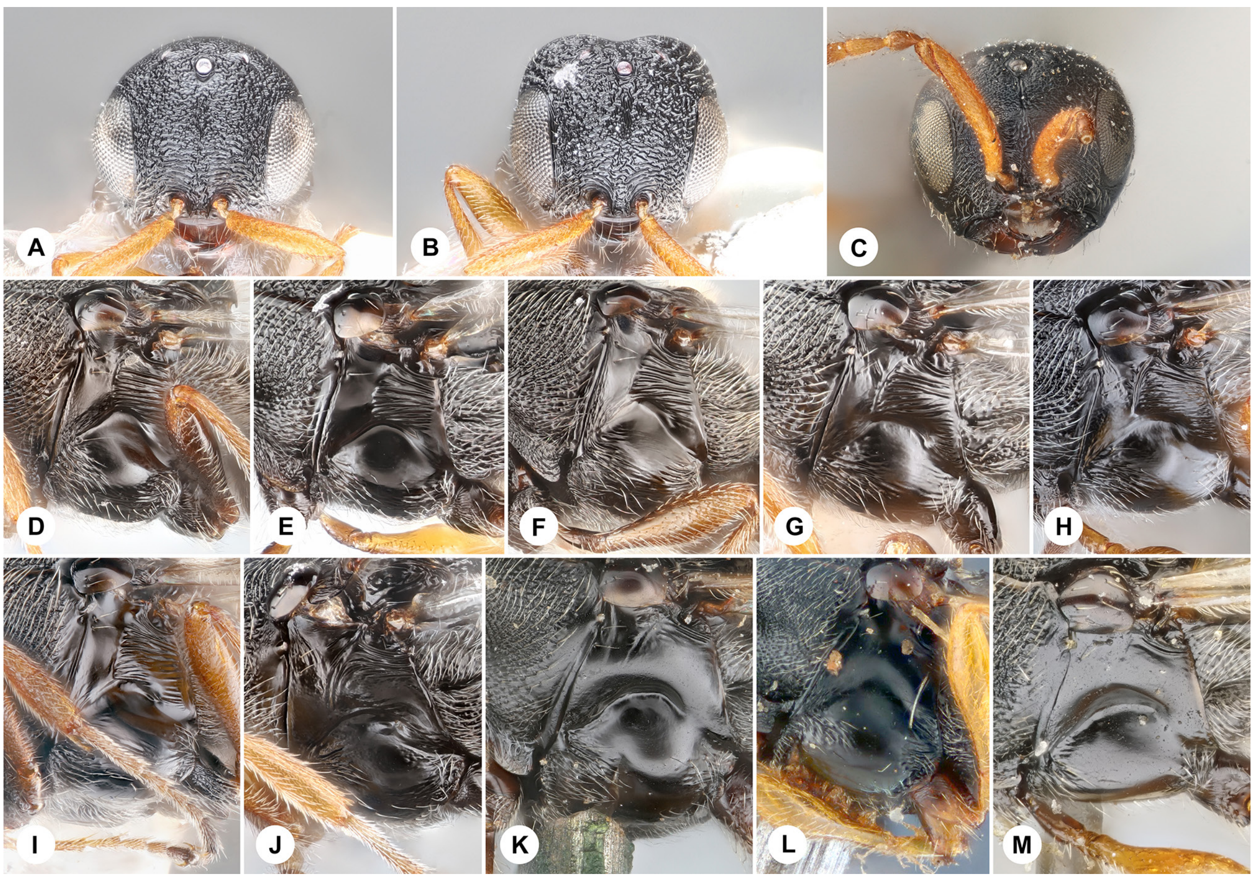


**Figure 3.** Species-level characters of *Isocybus*. (A–C) Anterior head. (A) Without medial excavation, SMNS_Hym_000878. (B) With medial excavation, SMNS_Hym_000871. (C) Without medial excavation, *Isocybus grandis*. (D–M) Mesopleuron. (D–F) Contemporary conspecific specimens. (D) SMNS_Hym_Pla_000864. (E) SMNS_Hym_Pla_000878. (F) SMNS_Hym_Pla_000880. (G–J) Contemporary specimens of different unidentified species. (G) SMNS_Hym_Pla_000871. (H) SMNS_Hym_Pla_000851. (I) SMNS_Hym_Pla_000859. (J) SMNS_Hym_Pla_000868. (K) *I. grandis* collected before 1834. (L) *I. grandis* collected before 1805. (M) *I. grandis* collected in 1925, Brandenburg, Germany, HNHM. Credit for images, J. Awad.

cies based on morphology (Fig. 3). Specimens resembling *I. grandis* have been collected in the Netherlands as recently as 2003, and in England as recently as 2009, although it remains uncertain whether they are truly conspecific and targeted search efforts have not been conducted outside of Germany.

## Search effort

The German Barcode of Life project (GBOL) operated Malaise traps throughout the country from 2012 to 2017 in order to survey the flying insect fauna of Germany (Caruso et al. 2024; Hausmann et al. 2020). From these traps, we obtained DNA barcodes for 1,233 vouchered specimens of Platygastridae, 12 of which were identified as belonging to the genus *Isocybus*. Based on DNA barcodes, these 12 specimens represent 5 different species. However, none of the species match the morphology of *I. grandis*.

The first author has examined all European specimens of *Isocybus* from 15 collections in 10 countries: Naturhistorisches Museum Wien (Vienna, Austria); Oberösterreichische Landesmuseen (Linz, Austria); Canadian National Collection of Insects and Arachnids (Ottawa, Canada); Natural History Museum of Denmark (Copenhagen, Denmark); Muséum National D'histoire Naturelle (Paris, France); Museum für Naturkunde (Berlin, Germany); State Museum of Natural History Stuttgart (Stuttgart, Germany); Hungarian Natural History Museum (Budapest, Hungary); Museo di Storia Naturale di Venezia (Venice, Italy); Naturalis Biodiversity Center (Leiden, Netherlands); Henk Vlug private collection (Scherpenzeel, Netherlands); Natural History Museum

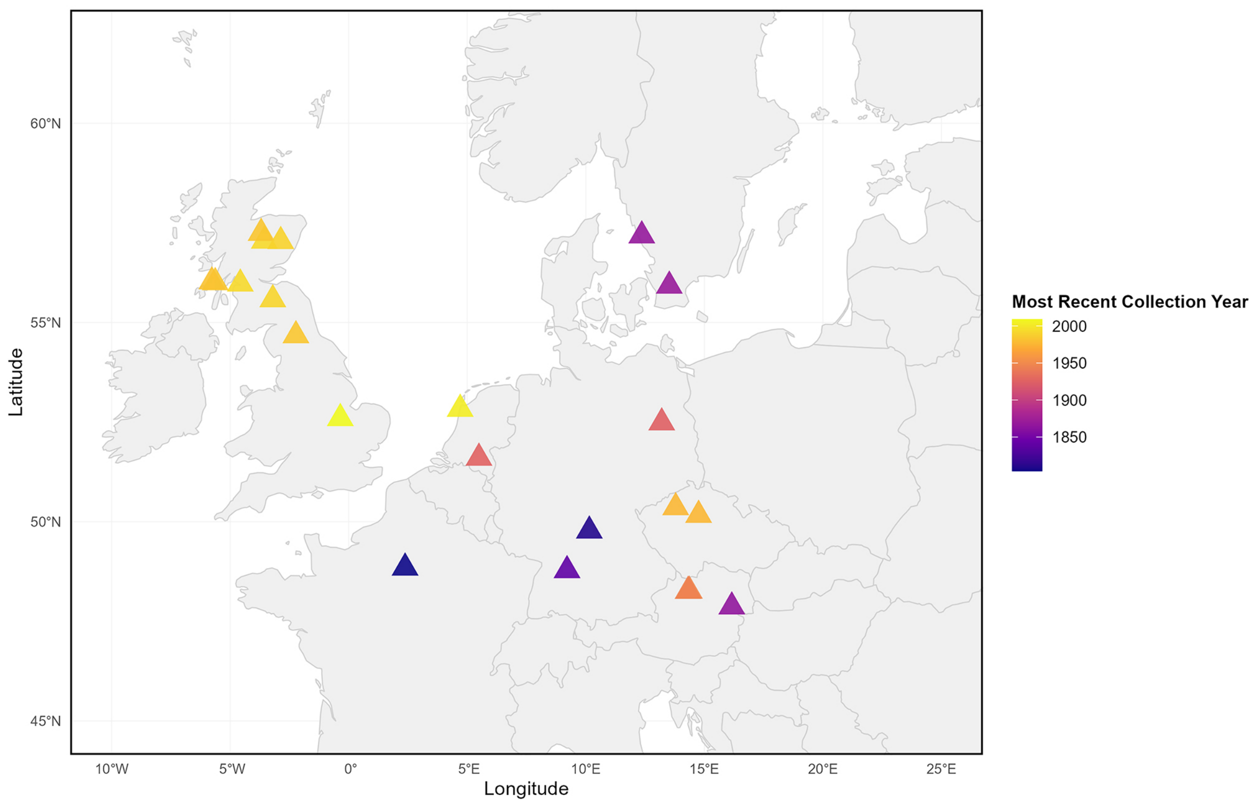


**Figure 4.** Distribution map of putative *I. grandis* collecting events. Color indicates most recent year of collection. Made in R (R Core Team 2025) with the packages ggplot2 (Wickham 2016) and viridis (Garnier et al. 2024) for visualization; sf (Pebesma 2018), rnaturalearth (Massicotte and South 2026), and rnaturalearthdata (South et al. 2026) for spatial and geographical data processing; and dplyr (Wickham et al. 2026) for data manipulation.

(London, UK); National Museum of Scotland (Edinburgh, UK); C.A. Triplehorn Insect Collection (Columbus, OH, USA); National Museum of Natural History (Washington, DC, USA). The most recent specimens resembling *I. grandis* were collected in England in 2009, and the earliest before 1805 in Paris. Most Central European specimens were collected in the late 19$^{th}$ to early 20$^{th}$ century (Fig. 4).

Upon realizing that the only recorded species of *Isocybus* from Germany was not present in contemporary collections, we visited the type localities (Mainstockheim, Grosslangheim, and Sickershausen) in early October 2021 to collect fresh specimens by pan trap, sweep net, and aspirator. The landscape has changed significantly since the 1810s, and although we collected many parasitoid wasps by all three methods, none belonged to *Isocybus*.

## Threats

If *I. grandis* is an obligate parasitoid of some unidentified species of *Planetella*, and an obligate associate of some species of *Carex*, then it is likely restricted to wetland habitats. Germany has lost an estimated 84.6% of its wetlands in the last 300 years, much of which were destroyed by agricultural expansion in the mid-20$^{th}$ century (Fluet-Chouinard et al. 2023). Anecdotally, when we visited the original collecting locality of *I. grandis* in Grosslangheim, we encountered a hostile townsperson near a small pond ringed with sedges. He had been treating the pond with pesticides to control biting flies. There were almost no insects at the site. It is likely that pesticide contamination has affected many other small bodies of water throughout Germany (Liess et al. 2021).

Although the putative host, *Planetella*, is itself a dark taxon, there is evidence to suggest that some species may be rare, endangered, or extinct. Of the 15 *Planetella* species recorded from Germany, seven are considered "rare" and five are considered "very rare" (Skuhravá et al. 2014). In Czechia, where there has been more recent taxonomic work on Cecidomyiidae, 12 species of *Planetella* are considered regionally extirpated (Ševčik et al. 2023; Skuhravá & Skuhravý 2021). Habitat destruction and pesticide contamination are also possible factors affecting the distribution and abundance of *Planetella* species.

## Rediscovery strategy

Continuing search efforts should focus on protected natural areas, particularly wetlands, with robust *Carex* populations. A combination of sweep net, pan trap, and Malaise trap should be employed in order to account for any effects of collecting method. The original specimens were probably hand caught, but we have observed substantial collections of *Isocybus* in Malaise traps in the Netherlands. Appropriate placement of Malaise traps is important: the opening should face the stand of sedges.

*Isocybus grandis* is most likely to be collected in the spring and autumn. This is consistent with the activity patterns of other platygastrid wasps (Haas-Renninger et al. 2024). The original specimens were collected in May 1812 and October 1810; however, changes in climate over the last two centuries may have significantly affected the phenology of the species (Borges et al. 2025).

Rearing of putative hosts (*Planetella* spp.) could lead to rediscovery of the lost species, as well as provide crucial ecological data for this "double dark taxa" system, in which neither the host nor the parasite can be reliably diagnosed at the species level (Awad et al. 2025). Rearing efforts should include any *Planetella* species besides *P. arenaria*, which has already been reared (Bruun et al. 2024; Vlug 1995), and which occurs in sandy habitats that are not consistent with the known collecting data of *I. grandis*.

Finally, the application of historical DNA (hDNA) techniques to museum specimens has potential to greatly improve the detection of lost parasitoid species (Ferrari et al. 2023). If it is possible to obtain a DNA barcode sequence from a validated name-bearing historical specimen, the sequence could be compared to the many unidentified insect sequences available from large-scale Malaise trapping and metabarcoding efforts (Buchner et al. 2025; Hausmann et al. 2020; Miraldo et al. 2025). Additionally, such parasitoid sequences could be detected through metabarcoding of host larvae or galls, contributing to the resolution of both taxonomic and ecological impediments.

## CONCLUSION

The case study demonstrates that the risk of extinction for parasitoid wasp species is probably underestimated due to limitations in the current research and conservation infrastructure. Contemporary material and historical records are both essential to understanding biodiversity loss over time. Especially in the case of dark taxa, preserved historical specimens are required, as the identifications of the past are unreliable. Trained local taxonomists are crucial, not only for identification of parasitoids, but similarly for insect hosts and host plants as well. The importance of natural history also cannot be overstated. If we wish to untangle the many factors maintaining biodiversity in our ecosystems, we must be able to draw connections between properly identified species.

There is considerable overlap between the lost species concept and the dark taxa concept (*sensu* Awad et al. 2025). Both lost species and dark taxa fall along the spectrum of shadow diversity (Turton-Hughes et al. 2024), an alternative conservation paradigm which accounts for unknown life. Many of the “described” species of dark taxa are potentially lost, having never been recorded since their original descriptions. In many cases, the only known specimen of the species is the holotype. However, search effort is required to determine whether a lost species is rare, threatened, endangered, extinct, or if it is merely scientifically neglected. Effective search effort requires some idea of habitat and phenology, as well as the ability to identify the organism if and when it is found. Taxonomic and ecological impediments are thus highly relevant to the study of lost species.

Parasitoids comprise an entire trophic level whose conservation status remains almost entirely unknown. They are small in size, phenomenally data-deficient, and not usually regarded as charismatic, when their existence is acknowledged at all. However, their importance to ecosystem function makes potential declines a matter of critical concern and of global significance. We hope to direct attention and resources to this serious problem, resulting in better-informed and more inclusive approaches to insect conservation and biodiversity research.

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**Data accessibility**

Specimen images, collection data, and DNA barcode sequences from GBOL III are available on Zenodo, https://doi.org/10.5281/zenodo.15552399.

**Author contributions**

J.A. conceptualized the study, conducted taxonomic and morphological investigations, created the figures, and drafted the manuscript. C.V. conducted molecular investigations. J.A. and C.V. conducted field work. A.H. provided German language support and local knowledge relevant to Bavaria. L.K. supervised the research and secured funding. All authors revised and edited the manuscript.

**Ethical standards and competing interests**

Field collecting was conducted in accordance with German law and with appropriate permits issued to the State Museum of Natural History Stuttgart. Access to museum specimens was granted by the holding institutions in accordance with applicable laws and professional standards. The authors declare no competing interests.

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