

COMMUNICATION

The past, present, and future of bee taxonomy in mainland China

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Abstract China has the sixth-largest bee fauna with over 1,300 documented species. Yet countless more are expected, making taxonomic work an imperative. Here, we outline the history of bee taxonomy in China and discuss how best we can move into the future and describe all of the many undescribed species remaining. Key challenges include the difficulty of accurately assigning species names due to overseas type material as well as a general need for increased internationalization such as in specimen and data sharing. Only with sustained funding for basic taxonomy will it be possible to know and protect China's unique bee fauna.

Key words Hymenoptera, Apoidea, Anthophila, systematics, review.

1 Introduction

Bees are reportedly declining worldwide (Potts *et al.*, 2016), but trends are unclear for regions such as Asia because even the most basic, foundational data such as distributional checklists are historically absent or lacking in most areas (Orr *et al.*, 2021; Warrit *et al.*, 2023, but see Ascher & Pickering, 2025). Case in point, the most-recent print catalog covering Asian bees was published >120 years ago (Dalla Torre, 1896). China luckily has received a recent catalog (Niu *et al.*, 2018), but it is already out of date, and the amazing undescribed biodiversity of China promises to greatly increase the number of recorded species there (Orr *et al.*, 2021). Without such baselines, how can we assess changes? Recent work has shown that, for some groups, we might expect the number of species to be doubled within even areas as small as Singapore (Ascher *et al.*, 2016), and with ten times the current number of species in much larger China, similar trends could require tremendous efforts to describe all the Chinese species, with great global impact. Only in a few groups, such as bumblebees, may the species be already largely known (Williams *et al.*, 2017). Given the early state of bee research in much of Asia (Warrit *et al.*, 2023), and the growing international bee community in the region, it is imperative that well-resourced countries such as China lead the way in modernizing our knowledge of the region's bee fauna.

China is a megadiverse country with nigh-unmatched topographic and habitat diversity. This has led to an astonishing level of species richness in groups such as mammals and vascular plants, comprising ~10% of world species for both (Liu *et al.*, 2003), not to mention immense and heavily-underdescribed invertebrate biodiversity (Li, 2019). This unique biodiversity is spread across many distinct biodiversity hotspots that comprise deserts, high mountains, and even tropical

rainforest (Olson & Dinerstein, 2002). Given the size and complexity of this country, much work remains to be done on the bees of China, despite their importance. Bees are especially vital for food security in China, given it has the world's largest human population but a minority of the country readily arable; managed bees are used surprisingly sparingly for crop pollination (An & Chen, 2011; Teichroew *et al.*, 2017; Warrit *et al.*, 2023), making wild bees especially crucial for their ecosystem services. As an example, when these services declined in apple in some regions, it became necessary for humans to hand pollinate them to sustain yields (Partap *et al.*, 2001; though notably this has now become a luxury trend). Yet, we do not know which species losses led to this situation. We must know which bees are present and their life history to protect them and the invaluable pollination services that they provide, so improved support of basic research is imperative (Zhu *et al.*, 2022).

不论平地与山尖
无限风光尽被占
采得百花成蜜后
为谁辛苦为谁甜

Whether plains or mountain peak
Occupying limited scenery
From hundred flowers gathering honey
For whom toilsome and for whom sweet

Box 1. An example of a Chinese poem about bees, *Bee* by Luo Yin (罗隐, 833–909, a Tang Dynasty poet), translated by Luo Zhihai adapted from *Complete Tang Poems* (全唐诗). Bees are a relatively common theme among insects for Chinese art and culture throughout history (Prendergast *et al.*, 2021).

At present, a modern synthesis is lacking in China for most bees, aside from the well-studied bumblebees (Williams & Osbourne, 2009; Williams *et al.*, 2017; *etc.*) and honey bees (Teichroew *et al.*, 2017; though note that much debate remains on subspecific classification for even honeybees; Qiu *et al.*, 2023; Su *et al.*, 2023), as is the case for many groups (Zhu *et al.*, 2022). This is symptomatic of broader issues in the region, as numerous other countries in East and South Asia are even more poorly understood (Warrit *et al.*, 2023). Here, we detail the history of taxonomic work on Chinese bees with focus on extant taxa, outline the present state of affairs, and highlight important future directions and the need for sustained support and international collaboration for bettering our knowledge of this enormous and unique bee fauna of mainland China.

2 History of bee systematic research in mainland China

For brevity and to ensure quality and completeness of our review, we specifically outline the history of bee descriptions of species originally collected within China, not including those which happen to occur in China but were described from other areas (except in counts). Further, we focus largely on mainland China for this historical review, given the distinctive island fauna and inaccessible materials of some Chinese territories such as Taiwan island. Current and historical counts are based on the authoritative, global DiscoverLife.org bee species checklist Ascher & Pickering (2025).

2.1 Eighteenth and early nineteenth century

During this period, taxonomic efforts were primarily focused inward, with western researchers focusing on local or at least more proximal fauna in large part, resulting in relatively few bee descriptions of species from China. First among descriptions of Chinese bees, Fabricius (1793) described the well-known Asian Honey Bee *Apis cerana* from “China.” Its lectotype is extant in Zoological Museum of the University of Copenhagen. Later, Westwood (1838) described *Xylocopa nasalis*, a species now well-known from coastal southern China inclusive of Hong Kong.

2.2 Mid-late 19th century

As collectors, hobbyists, and researchers traveled more broadly, and a stronger taxonomic firmament was laid in Europe, much quicker progress was made in documenting bees worldwide. Frederick Smith (1852, 1853, 1854, 1861, 1875, 1879), working on materials in the British Museum (now Natural History Museum, NHMUK), was the first to make extensive studies of Chinese bees, starting with descriptions of 23 currently-valid bee species from materials collected in “North China” by the Scottish botanist and plant hunter Robert Fortune, who is better known for smuggling tea out of China for introduction elsewhere. Bee species obtained by Fortune include six currently-accepted bumblebee species recorded as collected in the hills at Zhoushan (cited as Chusan), from Ningbo (as Ning-po-foo), and Tein Tung (a monastery in the hills S of Ningbo) in

Zhejiang Province, from Shanghai, and from Fuzhou (as Foo-cho-foo) in Fujian Province (Williams, 1991; Williams *et al.*, 2009a). Smith (1853) also described *Megachile* (*Creightonella*) *fervida* Smith, 1853 from Hong Kong. Smith (1871) later described two species of bees from Yunnan, the first from the interior of China, including *Bombus impetuosus* and, notably, the Himalayan Honey Bee *Apis laboriosa*, based on materials collected by the eminent Scottish anatomist and zoologist Dr. John Anderson during his tenure as first curator of the Indian Museum in Calcutta (or Imperial Museum at Calcutta) on an 1867 expedition with Colonel Edward Bosc Sladen.

The first bees from western China were also described by Smith, this time based on materials collected in the vicinity of Yarkand and Yengisar (Smith, 1878). These were obtained by the Moravian palaeontologist Dr. Ferdinand Stoliczka in May 1874, during the Second Yarkand Mission to Chinese Turkestan, during which he succumbed to altitude sickness. Whereas type specimens of most species described in Smith's previous papers (and in his last paper, Smith, 1879) are extant in the NHMUK, rendering them more accessible to subsequent workers in the West, the primary types obtained by Stoliczka were deposited at the Zoological Society of India Collection in Kolkata (see Baker, 1993), where at least some remain extant. As with many other developing countries, the existence of types in varied and far-flung institutions is a continuing challenge for Chinese researchers.

Russian entomologists made pioneering studies of the Central Asian bee fauna based on materials obtained in a series of expeditions in the late 19th century. Radoszkowski described *Megachile chinensis* Radoszkowski, 1874 (not Wu, 2006) and two species of *Thyreus* (as *Crocisa*, Radoszkowski, 1893) from the rather non-specific "Chine." Ferdinand Morawitz (1880, 1887["1886"], 1890) described 46 currently-valid species (some recognized due to homonymy under names proposed subsequently by Dalla Torre, 1896; Cockerell, 1912; Wang, 1979; Warncke, 1972["1970"]) based on collections made on expeditions by the famed Russian explorers and naturalists General Nikolai Mikhaylovich Przhevalsky, most noted for having discovered the wild horse that bears his name, and Grigory Nikolayevich Potanin. The latter led a major expedition in 1884–1886 to northern China, starting at Beijing (then Peking) and heading west and southwest to reach the Qinghai-Tibet Plateau. These expeditions laid the foundation for studies of the rich bee faunas of xeric northern and western China and included the first bees to be discovered in Sichuan Province where endemic elements in the Chinese fauna are best represented. Further research is needed to trace the routes of Przhevalsky's and Potanin's expeditions and to verify more precise type localities and collecting event data for the bees collected (sometimes even the province is unknown), and to verify the status of type materials, most of which is still extant in the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, ZISP). Pesenko and Astafurova's (2003) annotated bibliography of Russian and Soviet publications on the bees can be consulted for details of these and other historical publications relevant to China. Mocsáry (1892) described two bee species with types in the Hungarian Natural History Museum and Gribodo (1894) described *Megachile moutoni* (as *montonii*) based on materials deposited in the Museum of Natural History "G. Doria" in Genoa, Italy.

The currently-valid bee species that had been described from China by the end of the 19th century were mostly named by Frederick Smith of the British Museum or by Morawitz working in Saint Petersburg, Russia (specimens now in ZISP).

2.3 Early-mid 20th century

The 20th century saw an increased number of both foreign and domestic researchers in China. The first bee described from China in the 20th Century, by Vachal (1903), was an oil-collecting species taken by the first western discoverer of the Giant Panda, Père Armand David, at the type locality of that iconic species in Baoxing County (at "Mou-Pin"), and the bee was named *Ctenoplectra davidi* in his honor. Vachal erroneously attributed the locality to the "région de Pékin" [Beijing], but such a subtropical species could not survive there.

The most prolific describer of bee species worldwide, Theodore Dru Alison Cockerell (see Weber, 1965), was the first to describe bees from Xizang Autonomous Region (Cockerell, 1910a, b, c, 1911a; see also Meade-Waldo, 1912, 1913, Blüthgen, 1926). He named eight new species from NHMUK materials taken during the British Expedition to Tibet of 1903–1904, collected mostly or entirely by the English medical officer and naturalist Herbert James Walton (the locality "Khamba Jong, Sikkim, 15,000–16,000 ft." (=Kamba Dzong) is in Xizang, not Sikkim State of India, was visited in July 1903; Williams *et al.*, 2016). Cockerell (1911b) contributed types of four valid bee species to the National Museum of Natural History (Smithsonian, Washington, D.C., NMNH), including an anthidiine collected by Dr. William Louis Abbott at Kashgar in "Chinese Turkestan" (now Xinjiang Autonomous Region) and three anthophorine species from Beijing (as "Pekin") collected by M. L. Robb in 1901; he also described an *Anthophora* from Lanzhou based on materials from Berlin. Cockerell (1918a, b, 1919) continued works on Chinese bees with descriptions of three species from the eastern coast of China, including two *Andrena* and one *Osmia* collected at Suzhou (as Soochow) by the influential scientist N. Gist Gee.

With his increasing profile in describing bees, Cockerell was able to continue describing bees from China and elsewhere. Other notable collectors sending Chinese materials to Cockerell (1922), honored by his patronyms, and contributing to

building of the Smithsonian bee collection, were the missionary David Crockett Graham, collecting in Sichuan (see also Kuhlmann, 2007), and entomologist Prof. C. W. Howard, collecting at Canton (now Guangzhou). Cockerell (1926) described the widely-distributed and taxonomically-problematic *Amegilla dulcifera* from a specimen obtained at Qiling (cited as “Keeling”) in Guangdong Province collected by the extraordinary John Cheesman Thompson (also known as “Snake”). Cockerell (1927) described two Chinese bee species and deposited types in the American Museum of Natural History (New York, AMNH). Cockerell (1929, 1930) described six bee species collected by Arthur Paul Jacot at Jinan (cited as Tsinan) in Shandong Province, where he taught biology at Chee Loo University, with types deposited in the USNM and California Academy of Sciences (San Francisco, CAS). Yet another notable collector, Claude R. Kellogg, collected the NHMUK types of three anthophorine bees described by Cockerell (1930) from the vicinity of Fuzhou (as Foochow district). Cockerell (1931) made a major contribution to description of the bees of eastern China by describing 16 species (and 4 additional names now in synonymy) collected by Father Octave Piel, most of which were obtained at She Shan (as Zô-Sè) near Shanghai.

Several German hymenopterists also described species from China in the early 20th century. Heinrich Friese (1905[“1904”]) described four bumblebee species (and five additional names now in synonymy) from Sichuan (see revision by Williams *et al.* (2009a)) collected by G. N. Potanin or by his protégé M. M. Berezovsky. Soon after, Vogt (1908) described two additional *Bombus* from Lanzhou in Gansu Province obtained on the 1903–1905 Filchner Expedition to China and especially Xizang. At least some of the Friese and Vogt type materials are deposited in Museum für Naturkunde (Berlin, ZMB) and Naturalis (RMNH) collections, as are the types of four halictid taxa (two are currently valid species) collected by Leopold Conrad in 1890 from what is now Xinjiang and described by Embrik Strand (1909; subsequently Rebmann, 1968; Ebmer, 1972, later described a *Megachile* and a *Lasioglossum* respectively based on Conradt’s materials), and two more halictines described by him from Shandong Province (Strand, 1910). Further discoveries of Chinese bees were made by entomologist Rudolf Emil Mell at Canton (now Guangzhou) (Friese, 1911; Blüthgen, 1927) and by G. Siemssen in Fujian Province (as Fo-kien) (Friese, 1911). Friese (1914[“1913”]) described two *Colletes* species from “Mongolei” collected on the Roborovsky-Kozlov Expedition (one *Colletes* name was replaced by Cockerell, 1918b) that are believed to have been obtained in what is now China, and Strand (1913) published two *Andrena* species and two *Anthophora* (one a synonym and one with a replacement name by Brooks, 1988) from Pingshiang in Jiangxi Province. Strand (1915) later described six currently-valid species collected by W. H. Hoffmann at Qingdao (cited as Tsingtau) in Shandong Province (type materials in the Senckenberg Deutsches Entomologisches Institut, Müncheberg). Many of the Chinese bees described by German authors in the early 20th century have localities that are difficult or impossible to trace, exemplified by *Anthidium rufitarse* Friese, 1917, from “China, central.” Other bees described by Friese (1919) have known localities, *e.g.*, Shanghai for *Anthophora chinensis* Friese, 1919, but are still difficult to trace due to his failure to routinely cite collectors, dates of collection, or type repositories. Similar gaps in reported information impede our understanding of the two *Sphcodes* described from China by Meyer (1922), *e.g.*, *Sphcodes chinensis* and *Schecodes alfkeni* lack more specific locality information.

Blüthgen (1923, 1924, 1925, 1926, 1927, 1930, 1931, 1934, 1935) described twenty currently-valid Chinese halictine species as part of his detailed revisionary work on *Halictus (sensu lato)* and *Sphcodes*, with many types deposited in ZMB, or the Swedish Museum of Natural History (Stockholm) in the case of halictines collected in south Gansu Province by Dr. David Hummel in 1930 on a Swedish Expedition (Blüthgen, 1934). Friese (1935) also investigated Chinese bee species richness in detail, describing eight currently-valid *Coelioxys* species (one with a replacement name by Popov, 1946), most or all obtained by Father Octave Piel. Alfken (1936) described five Chinese bee species collected by Dr. David Hummel in 1930 on the Sino-Swedish expedition to China led by the explorer Sven Anders Hedin, namesake of two Alfken species and one of the *Bombus* described by Bischoff (1936). The Chinese endemic oil bee *Macropis (Sinomacropis) hedinii* Alfken was a notable discovery. Tkalců (1984), later described a new osmiine from this same Hedin Expedition materials. Hedicke (1940[“1939”]) described nine currently-valid bees from China in five genera, seven obtained at Jinzhou (cited as Kintschou) in Liaoning Province obtained by the entomological firm Staudinger & Bang-Haas, and two from East Tibet collected by Dr. H. Höne of Shanghai. The status of several of these species requires clarification through study of types in ZMB.

Bumblebees have seen comparably much more research than other groups in China, as is generally true worldwide. For example, the history of description for the large fauna of Sichuan is described by Williams *et al.* (2009a). Russian bumblebee specialist A. S. Skorikov (1912) pioneered specialized studies of Chinese *Bombus* with description of two species that had been collected in 1890 by the Russian Entomologist Grigory Yefimovich Grumm-Grzhimaylo. Another Russian bee specialist, V. B. Popov (1927), named one of the socially-parasitic (*Psithyrus*) from the northern slopes of the Sinin Mountains (mountains near Xining) in Skorikov’s honor. Frison (1933, 1935), Skorikov (1933, from materials in the ZISP), and later Tkalců (1968a) each described new species from Sichuan, of which *Bombus grahami* (Frison, 1933) and *Bombus religiosus* (Frison, 1935) were named in honor of their collector missionary David Crockett Graham, who made vast

contributions to the NMNH among many other accomplishments. Richards (1934) described the widespread bumblebee *Bombus picipes* from Taibaishan (cited as Taipaishan) in Shaanxi Province (holotype in NHMUK). Pittioni (1949) studied bumblebees collected in southeast China by J. Klapperich in 1937–1938 and described a new species from Fujian (type in NHMUK).

Studies of Chinese bees by Japanese entomologists began with descriptions by Keizo Yasumatsu (1935a, b, 1938a, b, 1939a, b) and colleagues (Popov & Yasumatsu, 1935) of bee species from northern China, five of which were from what is now Hebei Province (cited as Jehol). Strand & Yasumatsu (1938) described *Sphecodes manchurianus* and Yasumatsu (1938b, 1939a) described three *Megachile* from northeast China. Yasumatsu (1946) later described the long-horned bee *Eucera pekingensis* based on materials collected in Beijing (as Peking) in 1938 by K. Tsuneki, who became a prolific describer of Japanese parasitic bees (see Baker, 1993 for critical commentary), and Yasumatsu (1947) reported on desert bees of Inner Mongolia. Hirashima (1952, 1957) described *Andrena* collected before the Second World War in northeast China: *Andrena knuthiformis* Hirashima, 1952, taken by I. Okawa at “Kaigen” (Kaiyuan in Liaoning) in 1936 and *Andrena okabei* Hirashima, 1957, taken by K. Okabe in 1938 at Linkou in Heilongjiang. The type specimens are deposited at Kyushu University.

The eminent Russian entomologist V. B. Popov (see Pesenko & Astafurova, 2003) described *Stelis semenovi* Popov 1933[“1932”], from the Gobi desert and later three Chinese species in his revision of *Andrena* (*Plastandrena*) (Popov, 1949), which seems to have been neglected by subsequent investigators (e.g., two were excluded from the revision of *A. (Plastandrena)* of Eastern Asia by Xu & Tadauchi, 2011, due to lack of material, and the other, *A. alashanica*, was not mentioned). Popov (1959) also described four species of rophitine bees that had been collected in China long ago (1872–1908, most or all specimens in ZISP).

The Polish entomologist Jan Noskiewicz (1936) described four new species from China in his excellent early revisionary studies of *Colletes*.

Tsing-chao Maa was the first Chinese investigator to be recognized for contributions to the study of Chinese bees, beginning with his collection in 1936 of two species from Zhejiang Province described by Alfken (1937) and description that year of the carpenter bee *Xylocopa inconspicua* from “Nier-she-shan (likely Niushoushan), near Nanking” (Nanjing) in Jiangsu Province. His revisionary studies of East Asian carpenter bees commenced with review of his new subgenus *Bomboxylocopa* which featured a description of *Xylocopa frieseana* Maa, 1939, based on materials collected by F. K. To at Yinna Shan (cited as Yam Na Shan or Yit-nga Shan) in Guangdong Province and “deposited in the Lingnan Natural History Survey and Museum Canton” (current status of this type material needs verification). Continuing his studies of Xylocopinae, Maa (1954) described a new species, (*Proxylocopa*) *nix*, from Xinjiang. Two new *Trachusa* species that had been collected by Maa in Fujian that were described by the Greek entomologist Georgios A. Mavromoustakis as (*Paraanthidium*) *maai* Mavromoustakis (1953) and (*P.*) *xylocopiforme* (Mavromoustakis, 1954). This author had previously (Mavromoustakis, 1937) described a *Trachusa muiri* from “How Lik” in Guangdong Province, based on materials in the NHMUK collected by Frederick A. G. Muir. Later, Maa specimens collected in Fujian became the holotypes of *Ceratina* (*Ceratinidia*) *maai* Shiokawa & Hirashima, 1982 (holotype in the Bishop Museum, Honolulu, collected 1943) and of *Tetralonioidella fukienensis* Lieftinck, 1983 (see below).

The Czech entomologist Borek Tkalčů was an accomplished linguist and had a particular interest in Chinese bees in an era when most European specialists found it difficult to do entomological work on this fauna. He contributed greatly to knowledge of Chinese *Bombus*, which he classified in multiple genera, describing species and subspecies of both the pollen-collecting species (Tkalčů, 1961, 1968a, b, 1977) and of the socially parasitic species (*Psithyrus*) (Tkalčů, 1989). Tkalčů also studied Chinese Osmiini and described a new species of *Chelostoma* (Tkalčů, 1984, as *Archeriades*) from Hedin Expedition materials and a *Hoplitis* (Tkalčů, 2000, as *Eurypariella*) from recently-collected materials (from 1996). The *Chelostoma* was redescribed as *Chelostoma lamellum* Wu, 1992, an example of homonymy and other difficulties caused by limited communication during this period between Chinese and foreign bee specialists. For example, the new *Psithyrus*, originally described as *P. (Eopsithyrus) expolitus* Tkalčů, 1989 (now in the genus *Bombus* (*Psithyrus*)), was problematic in that its putative type locality of Kashgar in Turkestan is believed to be erroneous; it is now known to be a rare species of the eastern Qinghai-Tibetan plateau (Williams *et al.*, 2009a).

Twentieth-century European and American investigators had little access to new Chinese materials after the early 1940s, but some continued to describe new species from historical materials accessible in collections such as the NMNH, from which Lieftinck (1968) named three *Thyreus* from specimens collected in Sichuan in the early 1930s by D. C. Graham (see above) in his revision of the Palearctic members of this cleptoparasitic genus. An earlier, well-illustrated revision of the Indo-Australian *Thyreus* (Lieftinck, 1962) included most of the known Chinese species, but no new ones were described from China. Lieftinck (1974) also studied Chinese Anthophorini and described *Habropoda imitatrix* from Fujian (= *Habropoda zhejiangensis* Wu, 1983), depositing the type in his institution Rijksmuseum van Natuurlijke Historie (Leiden).

Lieftinck's (1983) revision of the misleadingly-named *Tetralonioidella* (similar in name to Eucerinae *Tetralonia* which they also do not parasitize), which he confirmed to be a cleptoparasitic genus in tribe Melectini, included description of *T. fukiensis* from Maa materials from the Bohea Hills, collected in 1939.

In summary, extensive study of Chinese bees by entomologists from the West began with descriptive work by Frederick Smith at the British Museum starting in the mid-19th century. Russian entomologists made important contributions, most notably Morawitz, Radoszkowski, Skorikov, and Popov, as did several German entomologists, notably Friese, Strand, Blüthgen, Alfken, and Hedicke. Japanese entomologists collected in Manchuria in the 1930s and this material was described by bee specialists such as Yasumatsu and later Hirashima. As is true of the world fauna as a whole, the two most prolific authors of bee names, Cockerell and Friese, each made major contributions, and also created challenges for future workers, *e.g.*, by dispersing types across multiple institutions (*e.g.*, AMNH, CAS, NHMUK, and NMNH, in the case of Cockerell) and not always labeling these clearly or consistently (Baker, 1993; Rasmussen & Ascher, 2008). Collectors of historical bee specimens, with professions ranging from military officer to missionary, included some of the most extraordinary explorers, naturalists, and polymaths of their respective eras, many of whom are celebrated for contributions to fields in addition to entomology. Among Chinese investigators, only T. C. Maa, working primarily in south China, made a major contribution documented in taxonomic publications during the 1930s–1950s.

2.4 Studies by Yanru Wu

The modern era in description of bee species in China has been dominated by the prodigious work of Yanru Wu, who has taken great lengths towards describing the previously under-documented species richness and distribution of China bees, and in particular its endemic faunas of Sichuan, Xizang, and Yunnan. Her types, deposited at the Institute of Zoology, Chinese Academy of Sciences (Beijing, IZCAS), establish this as the premiere center of Chinese bee studies and must be studied by all future investigators.

Faced with the challenge of documenting an immense fauna with few contemporary researchers to collaborate with, Yanru Wu published across many different bee groups. Early on, Wu (1962) described six species of Anthidiini collected 1955–1957 in Yunnan that are considered valid today, and Wu (1963) described three *Ceratina* species collected in the spring of 1955. Wu's (1965a) description of two species of *Macropis* oil bees now placed in the Chinese near-endemic subgenus *Sinamacropis*, established China as a centre of richness for these specialists of *Lysimachia*. These *Macropis* were collected at Omeishan (Emeishan) in 1957, and were among the first of many southwestern China endemics to be discovered by Chinese investigators. Wu (1977) described four new species of *Andrena*, three obtained in 1974 from previously under-collected Hunan Province. Wu (1978) described four endemic melittid species in three genera and Wu (1979) described four endemic Anthophorini in the genera *Elaphropoda* and *Habropoda*. Wu's most extensive work up to that time was her description of 37 taxa by Wu (1982d; of these 26 are currently valid and one is a valid subspecies; one homonymous *Andrena* name was replaced by Gusenleitner & Schwarz, 2002, and another by Wu, 2000b), from Xizang, in genera such as *Dufourea* (four species, as *Halictoides*; Wu, 1987b described three additional species from there; and Wu, 1990a, described an additional six species mostly from western China), *Andrena* (12 species), and *Anthophora* (five species, one as *Clisodon* at the generic level). In that same year she described new *Andrena* and *Xylocopa* from western China (1982a, b) and described what has subsequently been proven to be a widely distributed forest-associated subgenus of *Nomia* (Wu, 1982c). This was followed by descriptions of additional species (Wu, 1983a, b, c, d, e, f, 1984), most from Yunnan, in several genera notably including *Nomia*. The carpenter bee *Proxycopa* (*Proxycopa*) *sinensis* Wu, 1983, required a replacement name when removed to genus *Xylocopa* (already including a homonymous *sinensis*), supplied by Ozdikmen (2010). Wu (1985a, b, c) and He & Wu (1985) described additional species from western China, and Wu (1985d) described seven new species from Xinjiang. Wu (1987a) described six *Hoplitis* species from diverse localities, whereas Wu (1990b) described Osmiini and other bees from recently-explored sites in Inner Mongolia. Wu (1987b, c) respectively described three *Dufourea* species and one *Andrena*. Wu (1982c, 1985a, 1988a) described additional *Anthophora* species, two of which are now known by replacement names by Brooks (1988, as is another species described by Strand, 1913; Brooks also described a new species from Xinjiang), homonymy resulting from Wu's partition of *Anthophora* into multiple genera now generally no longer accepted (Orr *et al.*, 2018), though they saw variable use prior. Additional descriptions by Wu (1988b) of *Nomia* (*Maculonomia*), *Melitta*, and *Coelioxys* contributed to documentation of the montane fauna of Xizang, whereas Wu (1993[“1992”]) described 17 species, mostly megachilines, from Sichuan and Yunnan provinces (one replaced due to homonymy by Wu, 2006). Wu (2000a) greatly advanced our knowledge of Chinese Anthophorini through description of 14 species, with an additional six species described belonging to five other tribes. In 2004, Wu described a dozen Chinese Anthidiini (Wu, 2004b, c) and ten species of Osmiini (Wu, 2004a; one of these was described as a *Stenosmia* but has since been removed to genus *Hoplitis incertae sedis* by Müller, 2014, resulting in homonymy). Wu (2005) further advanced studies

of Megachilinae in a paper describing 14 species of *Megachile* resin and leaf-cutter bees. Wu's megachilid studies continued with descriptions of one *Lithurgus* and two *Coelioxys* (and an additional replacement name) in a major monograph reviewing the entire Chinese megachilid fauna (Wu, 2006).

It cannot be over-emphasized that Wu has made globally-important contributions to understanding the immense richness of Chinese bees. Without her efforts, tens of species would likely remain undescribed even today. This is especially true for certain taxa, notably Nomiinae (Wu, 1983d, 1988b; He & Wu, 1990; Huang *et al.*, 2007), *Macropis* (*Sinomacropis*) (see Wu & Michener, 1986), and Anthophorini (*e.g.*, Wu, 1991, 2000a), where her studies have revealed remarkable and previously underappreciated morphological diversity. In addition to numerous papers featuring species descriptions (see above), she provided faunal reviews of economically important insects (dating back to Wu, 1965b) and ecologically important sites (*e.g.*, Wu, 1997).

2.5 Modern bee specialists in addition to Wu

The first Chinese worker to publish descriptions of bee species subsequent to Maa and Wu was Jianguo Fan (1990, 1991; Fan & Wu, 1991), who initially described two species of halictines from western China. Fan's (Fan & Ebmer, 1992a, b) description of 11 new halictine species (and one synonym) alongside the great Austrian halictid specialist Andreas Werner Ebmer was notable as an early, successful collaboration between Chinese and foreign bee experts. Ebmer had previously included Chinese materials in a series of taxonomic papers on Asian Halictidae (Ebmer, 1972, 1978a, b, 1980, 1982) that reassessed and extended historical studies by Blüthgen. Ebmer also collaborated with the Japanese expert on halictids and other bees, S. F. Sakagami, to describe a *Lasioglossum* (Ebmer & Sakagami, 1994) now known to be widely distributed across China, the Russian Far East, and Japan. Later studies by Ebmer (1995, 1996) including descriptions of Chinese bees also placed previously-known species in modern species groups and updated their distributions. Ebmer (2002) included descriptions of 21 new species of *Lasioglossum*, with types of 17 of these deposited in Oberösterreichisches Landesmuseum of Linz. All but three species were described as *Lasioglossum* (*Evyllaesus*) (but many have subsequently been removed to more narrowly delimited subgenera, see Gibbs *et al.*, 2013), whereas Ebmer (2005) described two new *Halictus* (*Seladonia*).

Another leading halictid specialist, Yuriy Andreevich Pesenko, did collaborative research with Wu, starting with description of a new *Ceylaliectus* (*Atronomioides*) *hainanicus* Pesenko & Wu, 1991, from its namesake island and continuing with the description of four Halictini from Yunnan (Pesenko & Wu, 1997), including three species as *Pachyhalictus* (now *Patellapis*). Later, another sign of internationalization, Pauly (2009) reviewed Chinese species, including species described by Wu, in his revision of Oriental Nomiinae (also describing one new species of *Lipotriches* (*Rhopalomelissa*)).

Working independently from European specialists on the halictids, Niu *et al.* (2004) described a *Halictus* (*Seladonia*) from southwestern China, Zhang *et al.* (2011) described two species of *Lasioglossum* (*Hemihalictus*) *sensu* Gibbs *et al.* (2013) (as *Lasioglossum* (*Sudila*)), Zhang *et al.* (2012) described two new species of *Lasioglossum* (*Lasioglossum*), and Niu *et al.* (2013c) described a new *Homalictus* species from Yunnan. Many additional papers summarized the current state of taxonomy and provided valuable English redescriptions and keys, such as for the rophitine halictids (Niu *et al.*, 2005) and the *Halictus* subgenus *Vestitohalictus* (Niu *et al.*, 2007). Later publications on halictids include the description of a new *Thrinchostoma* (Niu *et al.*, 2016a) and a new *Lasioglossum* (Niu *et al.*, 2020).

Xu (1994) initiated his studies of Chinese *Andrena* with description of five species (one now with a replacement name by Gusenleiter & Schwarz, 2002). His collaborations with Tadauchi of Japan on revisionary studies by subgenus of the East Asian *Andrena* fauna included descriptions of many new species from China (Tadauchi & Xu, 1995, 2000, 2002, 2003, 2004; Xu & Tadauchi, 1995, 1999, 2001, 2002, 2005a, b, 2006, 2009a, b, 2012a, b; Xu *et al.*, 2000; Tadauchi *et al.*, 2005; additional publications revised already named species, *e.g.*, Xu & Tadauchi, 2011, including *Andrena* described by Wu, 1977, 1982a, c, 1985d, 1987c, 1993, 2000b) and compared these to the well-studied Japanese fauna previously reviewed by various papers from Hirashima and Tadauchi. Grünwaldt *et al.* (2005) described three new Chinese *Andrena* in support of orchid pollination studies conducted in the Zhongdian vicinity of Yunnan in June 2002 by Hans Bänzinger. In 2006, a new *Andrena* species, *A. (Larandrena) susanneae* Dubitzky (2006) was described based on material obtained by V. Alin in Harbin (as Charbin) in 1954. Ongoing work on the group in China suggests that there is more work yet to be done (Wood, 2024).

Bänzinger's orchid studies (see above) also resulted in discovery of a new yellow-faced bee, *Hylaeus* (*Nesohylaeus*) *sinensis* Dathe, 2005. Another yellow-faced bee species was described by Chen & Xu (2009) and by Chen *et al.* (2010), whereas Chen & Xu (2013) described five currently valid species from Yunnan, all collected by Huan Chen on 8–10 June 2012, three of these from the Napa Lake La Prairie protection zone in Zhongdian County. An additional four *Hylaeus* species were described by Dathe (2015) based on material collected in Sichuan by J. S. Ascher, L. Ding, Z.Q. Niu, and J. G. Rozen on a 2011 AMNH-IZCAS expedition. Notably, three of the new species were discovered on 5 June in the pine forest on Lushan above Qinghai Lake. The repeated discovery of multiple species suggests that more undescribed species of *Hylaeus*

are likely to be discovered with further work. Dathe's studies were important in that his familiarity with the Palearctic fauna informed his interpretation of these and other Chinese species.

Major Donald Baker studied Chinese material in his dissertation on the exotic bees described by Frederick Smith (Baker, 1993) describing new Chinese bee species in the course of his extensive studies of the Asian fauna. Baker (1997) described a new *Melecta* from 15,000 ft. elevation in Xizang that had been collected in 1924 by Major Richard William George Hingston on an Everest Expedition and also the extraordinary endemic melectine *Sinomelecta oreina* Baker, 1997, a new genus and species, from Sichuan (male holotype, now redescribed in 2012, labeled as from Ta-hsueh Shan or Chiungshia; see Engel & Michener, 2012).

Colletes specialist Michael Kuhlmann began his work on Chinese members of this genus with description of *Colletes alini* Kuhlmann, 2000, from Harbin (as Charbin) in Heilongjiang Province, followed by description of six new species in a review of the *Colletes* of Xizang (Kuhlmann, 2002) based on materials collected by Ernst Krause in May–June of 1939 during the 1938–1939 German Expedition to Tibet. The first major study of the *Colletes* of Sichuan (Kuhlmann, 2007) featured description of three new species based on NHNH materials collected long ago by D. C. Graham (see above). Following the establishment of international collaborations, a major review of the *Colletes clypearis* species group of China (Niu *et al.*, 2013a) included descriptions of seven species, and Niu *et al.* (2014a, b) together described three additional *Colletes* species. Additional efforts on this group in China include a synthesis of the known *Colletes* (Niu *et al.*, 2013a, b, 2014a, b). These efforts relied on a great deal of newly-collected materials that would prove the basis of numerous subsequent reviews focused on other Chinese bees. Yet, as of 2021, new species of this genus are still being found and described (Ferrari *et al.*, 2021), demonstrating that much work remains to complete a true accounting of Chinese bee diversity.

Relatively less-studied than some other groups in China (aside from for pollination), taxonomic work on recently-collected megachilids included descriptions of new species of *Bathanthidium* from Hainan (Niu *et al.*, 2012a) and then later a fuller revision of the group with another new species (Niu *et al.*, 2019a), as well as of *Megachile* (*Chelostomoda*) from Guangxi Province (Niu *et al.*, 2012b). A revision of the *Anthidiellum* moved numerous species from *Trachusa* to it (Niu *et al.*, 2016b), though a subsequent review of *Trachusa* included the description of three new species (Niu *et al.*, 2019b). Given the high number of previously-undescribed species in an area as small as Singapore (Ascher *et al.*, 2016), much more work is likely needed on this family in China.

Although megachilid bees have been a primary focus of late, Niu has also described bees from numerous other groups in recent years, including reviewing Chinese *Tetralonioidiella* cleptoparasites, describing several new species (Niu *et al.*, 2017). Several additional works have also focused on halictid bees (Zhang *et al.*, 2020, 2022a). Many of these efforts have been in collaboration with international scientists, to better enable the comparison of Chinese species with those described from adjacent countries for which no verified materials may be available in China, a significant challenge in most countries in the region (Orr *et al.*, 2020b; Warrit *et al.*, 2023). For instance, collaborations between Russian and Chinese scientists such as Yulia Astafurova and Maxim Proshchalykin include work on the Chinese *Sphecodes* and documented several new synonymies and new records (Astafurova *et al.*, 2018, 2020), and ongoing collaborations target additional groups such as *Hylaeus*.

We now know that China has the highest species richness of *Bombus* in the world (Williams, 1998), peaking within China in Sichuan and Gansu (Williams *et al.*, 2017). Bumblebees are perhaps the best-known bees in China after honey bees, with a long history of work that can only be briefly summarized here. Building upon many earlier faunal works from the last 60 years (*e.g.*, Tkalců, 1961, 1968a, 1977, 1989; Wang, 1979, 1982, 1985, 1987, 1993; Wang & Yao, 1992, 1993, 1996, 2004) and extensive new field work, there has been much more revisionary taxonomic research on Chinese *Bombus* in the last two decades. International collaboration has extended this to global revisions of several bumblebee subgenera, establishing many synonyms and including invaluable diagnostic keys for this difficult group (Williams *et al.*, 2009a, 2011, 2015, 2016, 2017, 2020, 2022a, 2023; An *et al.*, 2011, 2014; Williams, 2018, 2021; Thanosing *et al.*, 2023) that is not made easier by many regional mimetic convergences (Williams, 2007). Such studies contribute an essential component to global phylogenetic and biogeographic analyses (Williams *et al.*, 2022b). A new species from Sichuan was published in 2009 as *Bombus* (*Pyrobombus*) *wangae* Williams *et al.*, 2009a in honor of Shufang Wang and, subsequently, other new bumblebee species have been described in subsequent works (Williams, 2021; Williams *et al.*, 2011, 2012, 2020, 2022a, 2023). Despite all of these efforts, notably the male of the peculiar high mountain *B. tanguticus* still remains unknown (Williams, 2018), and isolated mountain ranges of the Qinghai-Tibetan Plateau might still hold new species for even this better-known group. Despite this tremendous richness of species in China, comprising over half of the world's species, we are now approaching a time when a synthetic "Bombus of China" ought to be possible, which would greatly benefit potentially much-needed conservation and managed pollination efforts in China (Xie *et al.*, 2008; Williams & Osbourne, 2009; Williams *et al.*, 2009b, 2010; Orr *et al.*, 2022a). Other social corbiculate bees have also seen substantial work, and for honey bees (*Apis*) the huge depth of work would

require its own full review paper (Qiu *et al.*, 2023), best dealt with elsewhere. In contrast, much more work is necessary to understand the stingless bees of China, with numerous new country records of species in just the last few years and burgeoning management efforts (Li *et al.*, 2021, 2022).

3 Summary of trends in description

At present, following the above revisionary and distributional works (in addition to other new records), China has 1,344 bee species recorded across 68 genera in six of seven bee families (Ascher & Pickering, 2025), making it the sixth-most species-rich country overall for bees based on described species alone, first within Asia (India at second in Asia, 21st globally; Warrit *et al.*, 2023). Temporally, these descriptions took place in bursts over time, reflected in the authorship history we have just detailed (Fig. 1). Notably, the present day is the continuation of one of the fastest periods of description, begun by the work of Yanru Wu and continued by numerous of her students.

Species descriptions in China have taken place in a wide variety of different provinces (Fig. 2). Historically, substantial numbers of species have been described from areas with high populations such as Beijing, Shanghai, and Guangdong, among other areas in eastern China. However, based on recent trends, south and west China appear to be hotspots of new species descriptions, suggesting that these relatively less accessible areas (due to accessibility issues, Hughes *et al.*, 2021) are only now being fully explored (especially Sichuan, Xizang, and Yunnan). It may be that this is due in part to faunistic similarities across much of the Palearctic, although there has also been a recent uptick in species descriptions from Xinjiang. Clearly, the highly heterogeneous environments of China hold a great number of additional undescribed species and country records of bees.

Interestingly, species described from within China and those described from outside of China show different trends, as a consequence of major recent taxonomic efforts within the country, largely led by Chinese researchers. Although many types collected in China are held in western institutions, ultimately this is a less severe impediment than for many other countries where nearly or all of their types are held outside of their borders. Our knowledge of Chinese bees is the result of combined Chinese (40% of species 966 described from China) and foreign (60%) research efforts (Fig. 3), with a higher percentage of national descriptions than is seen in many nearby countries, especially given the recent (post-1950) high number of descriptions by Chinese researchers. Thankfully, the vast majority of species described by Chinese researchers are housed in-country, in Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

4 Looking from the present to the future

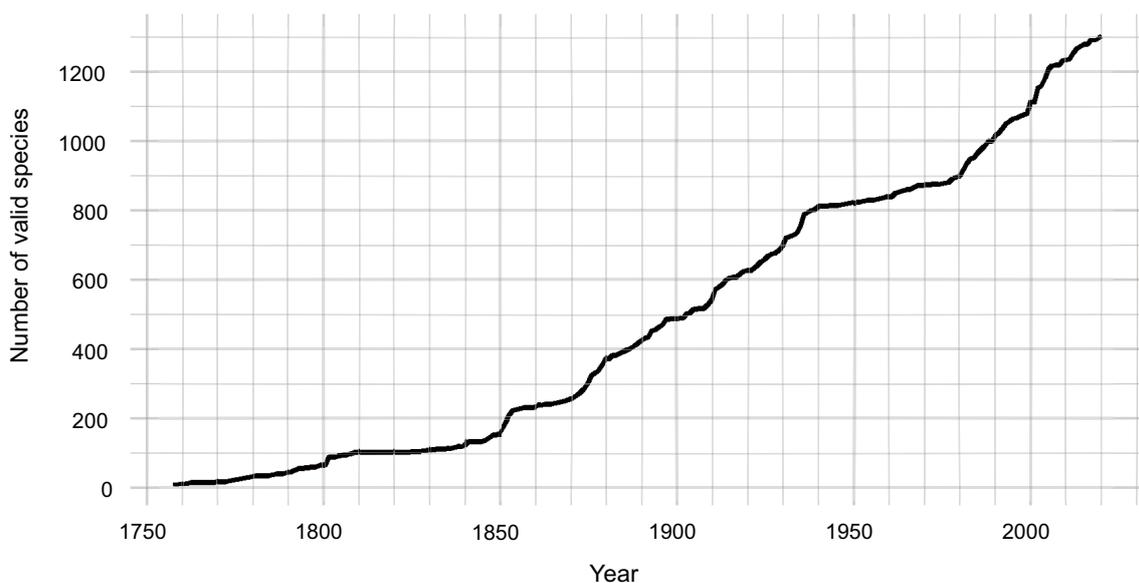


Figure 1. Species accumulation curve for China. Number of valid species found in China only (including Macau, Hong Kong, but not other islands). The black line is the actual data from (Ascher & Pickering, 2025).

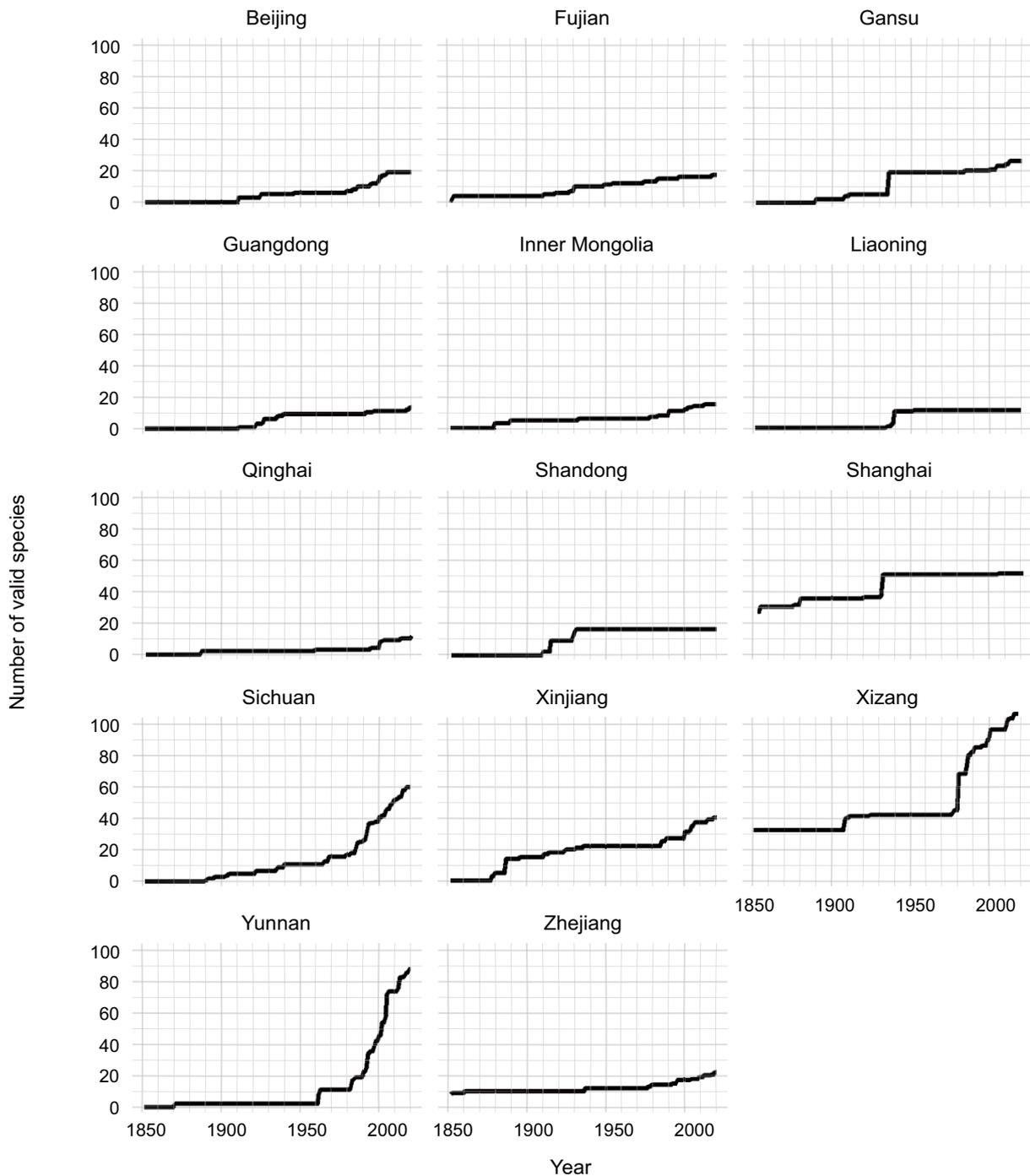


Figure 2. Number of valid species descriptions from select provinces of China. Only provinces with more than 10 species are included, and they are ordered alphabetically by province name. Based on Ascher & Pickering (2025).

Thousands of new bee specimens have been collected throughout China in the past two decades. They are the result of both the efforts of individual labs and major national programs such as the Second Tibet Expedition Program and “Investigation and evaluation of pollinator insect resources in Eastern China” (National Science & Technology Fundamental Resources Investigation Program of China), and various site-specific inventories of areas such as national parks. However, traditional taxonomy has become less popular in China, making it a challenge to recruit and train the next generation of bee taxonomists, as there may be few permanent positions available for them (Orr *et al.*, 2020a; Zhu *et al.*, 2022; Warritt *et al.*, 2023). Western countries have largely undergone this same transition, but they are different in that many countries saw hundreds of years of traditional taxonomic work prior to such declines, such that areas like China are consequently comparatively understudied. Balancing traditional practices with novel technologies, future generations of bee taxonomists

will increasingly be expected to integrate new and exciting evidence and approaches into their systematic studies on bees (Orr *et al.*, 2020a). However, it is important not to forget the necessity of basic taxonomic research, as otherwise bees cannot be effectively identified and protected.

Molecular analyses are critical among the new methods systematists must employ in their work, used for everything from delimiting species to mapping their relationships over time. DNA barcoding, especially with cytochrome-oxidase-I, has been especially popular with bees as an added line of evidence for distinguishing species (Niu *et al.*, 2013b, 2014b; Huang *et al.*, 2015). Some bumblebee studies have taken this further and integrated morphological studies with formalized gene-coalescent or other analyses, seeking to identify the distinctions between species in a consistent and accountable way (Williams *et al.*, 2012, 2016, 2020, 2022a, 2023; Luo *et al.*, 2018; Williams, 2021). This integrated approach has the promise to discern between widespread polytypic species, on the one hand, and complexes of local species, on the other (Williams *et al.*, 2020). Following initial studies on lesser-known groups, such endeavors will likely reveal further undescribed diversity, as has happened for bumblebees. As distributional data become more available for bees in the region, methods like environmental niche modeling can also be incorporated for truly integrative systematic efforts (Orr *et al.*, 2014). In light of difficulties identifying bees from some regions, such as the tropics, some studies have also integrated DNA barcoding into ecological studies on bee communities in China (Liu *et al.*, 2017). Although notable success is evident in barcoding the fauna of areas such as Canada and the United Kingdom (Magnacca & Brown, 2012; Tang *et al.*, 2015; Sheffield *et al.*, 2017; Creedy *et al.*, 2020), the size of the fauna and rarity of many species makes this much more challenging for China (Williams, 2022; Williams *et al.*, 2022a). Nonetheless, substantial local efforts are being made to build up a national barcoding reference library, not just for identification but for large-scale phylogenetic analyses such as for traits (Xie *et al.*, 2023). Researchers are also pioneering multiple methods for metabarcoding plant pollens (Bell *et al.*, 2019; Lang *et al.*, 2019; Peel *et al.*, 2019). These new methods aim to more precisely quantify the percentage content of different pollens within mixed samples, a major issue obscuring our knowledge of specialization, a crucial underpinning of bee-plant interactions (Ren *et al.*, 2018).

Genomic efforts have kept pace well with global efforts on that front, but historically focus has been largely on honey bees (Chen *et al.*, 2016, 2018; Montero-Mendieta *et al.*, 2019; Ji *et al.*, 2020; Wang *et al.*, 2020; Cao *et al.*, 2023; Qiu *et al.*, 2023; Li *et al.*, 2024), with bumblebees only recently receiving substantial focus (Zhao *et al.*, 2018; Sun *et al.*, 2021, 2023). Looking forward, as Chinese researchers begin to sequence the genomes of less-studied, solitary bees (Zhou *et al.*, 2020; Zhang *et al.* 2022b; Ferrari *et al.*, 2023), it seems likely that these types of data will be increasingly used for systematic studies on Chinese bees, especially in the realm of phylogenomics (Zhang *et al.*, 2019; Orr *et al.*, 2020a; Branstetter *et al.*, 2021). Indeed, recent efforts at resolving phylogenetic relationships for both the subfamily Anthophorinae and large genus *Lasioglossum* have begun leveraging low-coverage genome sequencing (Zhang *et al.*, 2022c; Orr *et al.*, 2022b), including the use of alternative markers to the standard ultra-conserved elements most-often used for bees (Almeida *et al.*, 2023).

Despite all of the efforts on Chinese bees detailed at length above, much work remains. In fact, the authors expect that over 2000 species are present in China (Orr *et al.*, 2021 identifies it as a major hotspot of unrecorded species). This could make China the 2nd-most species-rich country for bees (although Australia and parts of Central and South America might still also yield many new species, keeping their leads). Though the immensity of the undescribed Chinese fauna may make things seem hopeless, especially when facing diminishing permanent positions for taxonomists, there are numerous ways in which we can improve our prospects (aside from the obvious answer of increasing funding for taxonomic ventures both in itself, and as part of larger inventory or ecological studies). For almost all of these species, much work also remains to understand their basic biology, such as their nesting biology (Ding *et al.*, 2007; Yang *et al.*, 2010; Rozen & Ding, 2012; Orr *et al.*, 2022c).

First and foremost, internationalization in bee taxonomy will be key for enabling and improving the description of Chinese bees. This is in terms of both collaboration and practices. Thankfully, almost all recent Chinese publications have been in English, enabling the reliable use and citation of these works both regionally and globally. This will be invaluable for preventing the unnecessary redescription of species under new names, a major risk in areas such as Asia where a wide variety of languages are spoken (similarly, increased use of the existent literature enables Chinese researchers to better avoid describing synonyms from neighboring countries). At the same time, Chinese researchers are increasingly coauthoring taxonomic publications with outside researchers, a key strategy for better incorporating species described from neighboring countries, for which types or verified specimens may be unavailable. These type specimens are invaluable for taxonomic revisions and their use should be centralized in all revisionary work. However, many Asian types are held in Western institutions, even though in China relatively more work has been done by in-country researchers (Fig. 3; Orr *et al.*, 2020b). As more researchers begin studying bees in Asia, it is increasingly necessary that type-holding institutions minimally digitally “repatriate” their holdings to the regions they come from, and thankfully many institutions are beginning to digitize their type specimens (American Museum of Natural History, Natural History Museum London, Museum für Naturkunde,

Smithsonian Institution, *etc.*). With these and other verified, high-resolution images as reference, researchers in Asia will be immeasurably better equipped to perform larger-scale, even global revisions of bee groups.

Resource sharing is also an issue regionally, with the barriers to international collaboration becoming ever higher. A surprising yet significant impediment exists in compacts designed to protect biodiversity (Prathapan *et al.*, 2018). Though well-intended, groups like the Convention on Biological Diversity and agreements such as the Nagoya Protocol greatly complicate matters by encouraging intense legislative regulation of specimen collection and the sharing of specimens or genetic resources, thereby preventing the free and easy sharing of knowledge between researchers. Although there are many ways in which these compacts can be improved, one quick initial solution would be to make clear exceptions in harsher legislative limits for purely-scientific, especially taxonomic, work (maintaining such limits for commercial activities such as chemical prospecting, *etc.*). If no such actions are taken to lessen these types of restrictions, it will only become more difficult for us to work across countries and the people of those countries will be disadvantaged compared to countries with fewer restrictions and easier collaborations.

Geographical borders are not the only boundaries we must surmount. Better integration is also needed between traditional taxonomy and molecular approaches, as too often there are different people doing these studies entirely separately. A key goal could be sampling species at their type localities for barcoding, mitogenomes, or even full genomes if such funding were available. In this way, it would be possible to build a library of verified DNA sequences to enable much more authoritative studies in systematics and beyond by coauthoring papers/collaborating more emphasized and seeking joint funding support needed on both sides. All of these efforts would greatly benefit from a truly unified data repository, including not only taxonomic or distributional information, but also minimally linkage to images, molecular resources, relevant

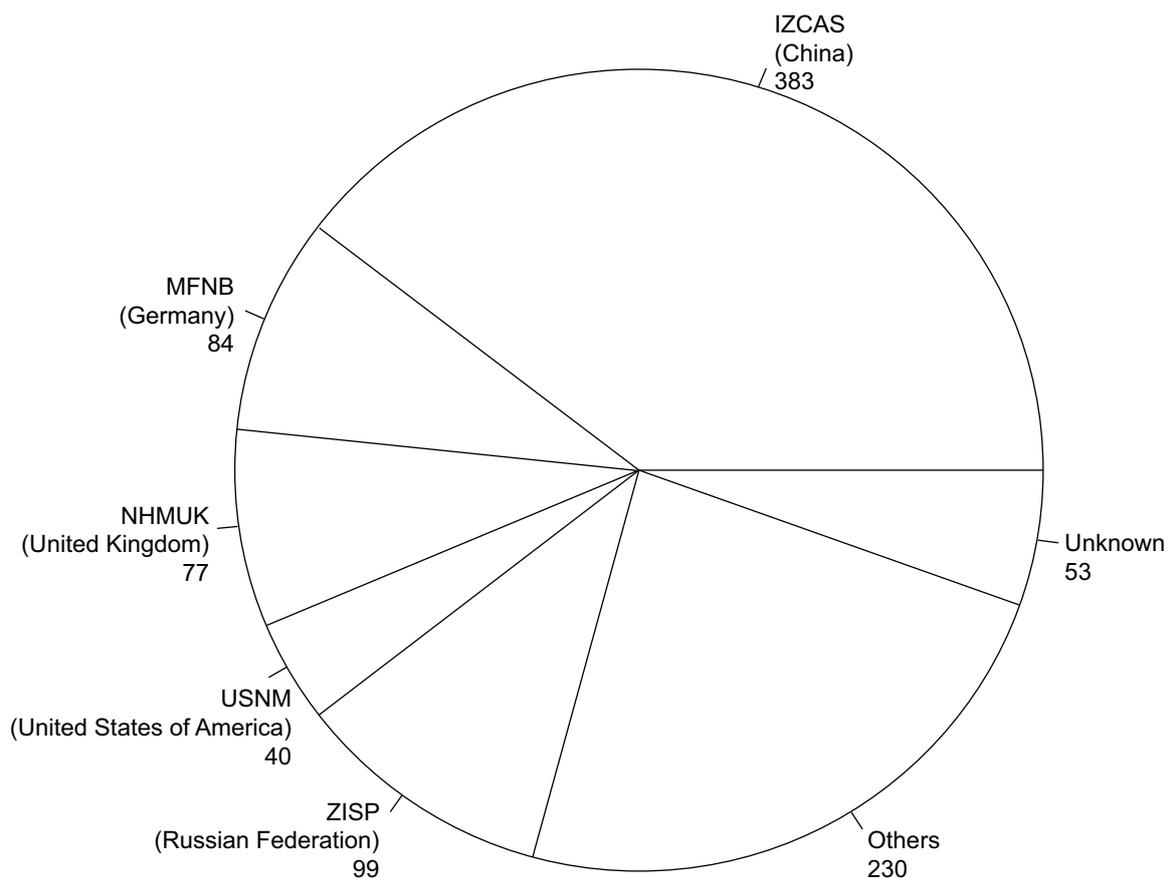


Figure 3. Number of Chinese type specimens in different countries and natural history repositories. This counts only species described from Chinese specimens, not including all species recorded from China. Only the top five repositories with the highest number of Chinese type specimens are presented, with the other repositories lumped as “Others.” Abbreviations: IZCAS—Institute of Zoology, Chinese Academy of Sciences, Beijing; MFNB—Museum für Naturkunde, Berlin; USNM—Smithsonian Institution, Washington D.C.; ZISP—Zoological Institute of the Russian Academy of Sciences, St. Petersburg. Both valid species and synonyms are included from Ascher & Pickering (2025).

literature, and other data for each species (Orr *et al.*, 2020b).

None of these important and necessary steps will be effective without strong leadership and direction both nationally and internationally. For this reason, developing an Asian Pollinator Initiative is a paramount task (Warrit *et al.*, 2023). This effort, linked in with the IUCN Wild Bee Specialist Group, is developing as an overarching network linking together different country-level networks, ensuring both sufficient representation across the region and enabling the use of funding at both national and international scales. This network will also serve to better share knowledge in the region, enabling easier access to specimens, data, funding, all to the benefit of increasing collaborative efforts. Such endeavors are critically needed to assess if, where, and how badly bees and other invertebrates are declining throughout Asia (Warrit *et al.*, 2023). We cannot protect species without first being able to identify them across their ranges, making international collaboration absolutely necessary. In this way, the challenges faced by this region can instead be viewed as a unique opportunity for China and Asia, especially the younger generation of taxonomists to lead with a synthetic, inclusive approach bringing taxonomists and other researchers together to know and protect bees and the invaluable ecosystem services they provide.

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