# HYMENOPTERA: STATUS, THREATS AND CONSERVATION APPROACHES

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***Abstract***

*The diversity of insects across the globe is reported to be declining rapidly. The International Union for Conservation of Nature (IUCN) has identified 77,435 of insect species between 1996-2020 from which 18,180 were reported under threatened category. Monitoring the actual status of any species forms the basis for its conservation. Hymenoptera order is regarded third biggest and diversified order of insects, which have evolved into a diversity of physical shapes and ways of existence. It has been reported from fossil records that Hymenoptera appear first in late Triassic period about 230 million years ago. The order Hymenoptera includes bees, ants, and wasps or hornets. The order Hymenoptera has over 115,000 described species and with estimates of one million to 2.5 million total species. Due to a variety of factors, including varying climatic conditions, interactions between species, geography, local history, and others, hymenopteran insect biodiversity exhibits a variety of patterns over time and place. This study presents clear information on Hymenoptera diversity, the status of global threats, and the prior conservation strategies.*

***Keywords:*** *Hymenoptera, Status, Diversity, Threats, Conservation*

## 1. Introduction

HYMENOPTERA is the third-largest insect order and may be the one that benefits humans the most (Ashok and Vedanthan,2019). One-third of all pollinators and an essential pollinator of blooming plants are bees (Warzecha, et.al., 2018). For thousands of years, they have been used as a source of honey and beeswax (Giampieri, et.al., 2022). Nearly 90% of all species of wild flowering plants depend, at least in part, on pollination by animals (Roy, et.al., 2017). In addition, biotic pollination, primarily entomophily, is necessary for 87 out of 115 staple food crops farmed worldwide. A similar pattern of extinction may be seen in bees, where one in every six species has gone regionally extinct, according to the analysis of threatened status. The present pollinator species extinction rate is 100–1000 times higher than average due to anthropogenic influences (Karlsson, et.al., 2021).

The first step in creating conservation strategies and taking preventative action before a species becomes extinct understands its threat status (Raghavendra, et.al., 2022). The International Union for Conservation of Nature (IUCN), Gland, Switzerland, conducts this activity on a global scale for all four kingdoms—Animalia, Plantae, Fungi, and Chromista—and it serves as a benchmark for extinction risk assessment around the world. The IUCN Red List is the only resource available for evaluating the danger level and extinction risk of species, which in turn helps prioritise conservation of key species and is essential for building support for species conservation among the general public and policymakers. The Red List procedure adopts an intrinsic value strategy and presumes parity across all species(Washington, et.al., 2018).

## 2. Methodology

Using Google Scholar and other search engines, data on the global threat status of order hymenoptera of insects was gathered from the IUCN as well as published literature and references therein on the species population loss. The number of threatened species in orders Hymenoptera was collected and tabulated from secondary sources. A literature review utilizing the Google search engine for each species listed in IUCN was conducted in order to determine which category a certain species belongs to using the existing IUCN data on vulnerable species. Several effective conservation initiatives for plants and animals have been carried out by

adhering to the IUCN Red List. Based on quantitative extinction risk criteria, every species in the IUCN system is categorised as either extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), or data deficient (DD).

## 3. Results

### *3.1. Status of Hymenoptera order of Insects*

The data of IUCN Red List Verision 2020.2 depicts that a total of 9425 insect species were assessed. The majority of assessed insect species were categorised as least concerned (4511), followed by vulnerable (791), endangered (641), near threatened (585), category critically endangered (322), extinct (61), lower risk (3), and extinct from wild (1) respectively. It was observed from the report of IUCN that highest number of threatened species was encountered in order Odonata (702), then 677 species in order Orthoptera, 368 species in Coleoptera, 271 species in Lepdoptera and 211 insect species in Order Hymenoptera.

**Table-1: Proportion of threatened species in different families of order Hymenoptera (source: IUCN Red List of Threatened Species, Version 2020.1).**

| **Status** | ***Sphecidae*** | ***Megachilidae*** | ***Melittidae*** | ***Andrenidae*** | ***Halicidae*** | ***Colletidae*** | ***Apidae*** | ***Formcidae*** |
|---|---|---|---|---|---|---|---|---|
| Total Assessed Species | **1** | **77** | **13** | **96** | **70** | **40** | **187** | **149** |
| Critically Endangered | **-** | **01** | **-** | **01** | **-** | **-** | **07** | **-** |
| Endangered | **-** | **-** | **01** | **02** | **03** | **03** | **09** | **03** |
| Vulnerable | **-** | **01** | **02** | **-** | **-** | **03** | **10** | **139** |
| Near Threatened | **01** | **-** | **-** | **-** | **3** | **05** | **11** | **06** |
| Least Concern | **00** | **75** | **10** | **93** | **64** | **29** | **150** | **01** |

*Source: IUCN Red List Version 2020.2*

In order Hymenoptera 633 species have been assessed by IUCN Red List Version 2020.2 . The order Hymenoptera is constitutes 08 families i.e., Apidae, Formcidae, Andrenidae, Megachilidae, Halicidae, Colletidae, Melittidae, and Sphecidae**.** The family Apidae belongs maximum 187 species, followed by Formcidae (149), Andrenidae(96), Megachilidae(77), Halicidae(70), Colletidae(40), Melittidae(13), and Sphecidae belonging a single species. Different species of hymenoptera fall under various categories of threat status( IUCN Red List, 2020) they include CR for *Andrena labiatula* and *Bombus affinis*, EN for *Colletes merceti* and *Halictus microcardia*, and VU for *Bombus mexicanus* and *Anergates atratulus.* The reports of IUCN Red List of Threatened Species, Version 2020 described that 09 hymenoptera species fall in critically endangered category, 21 hymenoptera species were assessed in endangered category, 155 hymenoptera species were encountered in vulnerable category,26 hymenoptera species fall in near threatened category, and remaining 422 hymenoptera species were categorised as least concerned.

Members of the Formicidae (ants) and Apidae (honey bees), two families of hymenopterans, are more vulnerable to extinction (Table-1). Nemesio, (2013) noted a 50% decrease in the population of all orchid bees that depend on forests in England. According to Kwon et al. (2014), one of the key reasons for the decrease in variety of ant populations found in their native habitats is habitat disturbance. According to Graham et al. (2004), highly disturbed areas featured fewer trees, less ground cover, warmer summertime soil temperatures, and more compacted soils with a shallow A-horizon, all of which together contributed to poorer ant species diversity. The most charitable insects are honey bees, which pollinate plants and help to increase crop yields. However, honey-bee diversity and abundance have plummeted since the introduction of synthetic insecticides for pest management.

### *3.2. Threats to Species of Order Hymenoptera*

There are many reasons of decline in diversity of species of hymenoptera. The primary causes of hymenoptera decline include habitat loss, changes in land use, deforestation, intensive agriculture, urbanisation, climate change, pollution, invasive insect species introduction, mass insect trapping using pheromones and light traps, pesticide use, pathological issues with various insects, and the introduction of exotic honey bees in new areas that compete with native bees for resource allocation and other management techniques. A significant factor in the fall of insects is

the use of chemical insecticides against target or non-target creatures. Fragmentation and deterioration of their habitats, particularly changes in land-use patterns, the use of pesticides, monocultures, and intensive agricultural techniques are other anthropogenic factors associated with the loss of insect cum hymenoptera diversity.

### *3.3. Conservation Measures for Order Hymenoptera.*

The International Union for the Conservation of Nature's (IUCN) species evaluations, particularly when it comes to insects, nearly always rely on professional scientific judgment, but they nonetheless help gauge our progress toward the goals of the global conservation of biodiversity. In the present study we have highlighted the status of order Hymenoptera, the treats which the species of this order is facing in the current period. Many authors have provided prior steps for conservation of insects, but across all of them Raghavendra, et.al.,(2022) has provided the most elite conservation strategies for insects. Keeping in view these conservation strategies the following steps should be taken for sustainable conservation of species of hymenoptera;

***i.*** The most effective strategy to stop future decrease of different species of hymenoptera order of insects, especially in regions where intensive agriculture is practiced, is probably habitat restoration combined with lessened pesticide use and redesigning agricultural.

***ii.*** The most endangered insect species of hymenoptera order require the development and application of conservation methods.

***iii.*** To enhance the status of threatened species of hymenoptera order, more efforts must be made to quantify pest threat levels and develop biodiversity regulations.

***iv.*** Re-evaluating current farming methods and raising awareness of the benefits of ecologically sound methods and prudent pesticide use

***v.*** There is a need to decrease the dangerous chemical run-off and leaching into waterways, especially pesticides.

***vi.*** Every ten years or as soon as new information becomes available, the IUCN Red List of Insects species of hymenoptera order should be updated.

***vii.*** In order to stop further deforestation, forests should be treated as a priceless natural resource that demands prompt attention.

***viii.*** More funding is required for conservation initiatives targeted at species of hymenoptera that are identified as endangered on the IUCN Red List.

***ix.*** The loss of several agriculturally significant insects, especially in annual crops, is seriously threatened by the agriculture ecosystem's extreme dynamisms and instability.

***x.*** Governments at all levels must create plans for protecting and restoring natural ecosystems, as well as taking drastic action to reduce greenhouse gas emissions and stop the harmful impacts of overusing numerous species of hymenoptera order.

***xi.*** For better coordination and future course of action for the welfare of the environment and society, international organisations and authorities like the Convention on Biodiversity (CBD), International Plant Protection Convention (IPPC), and Sanitary and Phytosanitary (SPS) of the World Trade Organization should be linked to each other and with IUCN.

***xii.*** Therefore, entomophage parks must be created by the public-private partners in order to reduce this and conserve such insects.

***xiii.*** Proper and update record of species of hymenoptera order of insects should be included in People Biodiversity Registers (PBRs) for conservation at panchayat level.

## 4. Conclusion

Compared to the preservation of plants and other animals, the preservation of insects has received far less attention. Insects are projected to respond to climate change differently than warm-blooded creatures like birds or mammals since they are ectotherms. Hymenoptera is the third-largest insect order and may be the one that benefits humans the most. Monitoring the actual status of any species forms the basis for its conservation. Hymenoptera order is regarded third biggest and diversified order of insects, which have evolved into a diversity of physical shapes and ways of existence. The family Apidae belongs maximum 187 species, followed by Formcidae(149), Andrenidae(96), Megachilidae(77), Halicidae(70), Colletidae(40),

Melittidae(13), and Sphecidae belonging a single species. Different species of hymenoptera fall under various categories of threat status. Members of the Formicidae (ants) and Apidae (honey bees), two families of hymenopterans, are more vulnerable to extinction. Fragmentation and deterioration of their habitats, particularly changes in land-use patterns, the use of pesticides, monocultures, and intensive agricultural techniques are other anthropogenic factors associated with the loss of insect cum hymenoptera diversity. Keeping in view the conservation strategies from local to regional level prior conservation strategies were designed of species of hymenoptera.

## CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest with the submission of this manuscript.

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