Ecological Role ofspidersinTerrestrialEcosystemandTheirConservationPriorities.

Abstract

Spiders are members of the phylum Arthropoda, the largest phylum of animal group in the worldunder the class Arachnida. Spiders are ubiquitous in distribution and invade almost every type ofhabitat, and are the most abundant invertebrate predators in terrestrial ecosystems. Nearly 47,617species of spiders under 4,092 genera in 114 families were recorded in the world. Spiders are akeycomponentofterrestrialecosystems,occupyingauniquepositioninfoodwebs.Aspredators, they are important in the regulation of invertebrate populations, which include pestspecies, and as prey they provide food for other invertebrates and birds. They are the importantcomponents of food chain. This is notwithstanding the contribution they make to ecosystems intheir own right. Spider silk has unique properties that have potential applications in medicineand technology.Many species of spiders have been used as medicines.As bee populationsplummet, spiders might be the next solution to the pollination process. Spiders are among themostfascinatingcreaturesonearth,andtheirimportanceinscientificresearchcannotbeoverstated.

Spiders play a critical role in maintaining ecological balance, and studying theirbehavior and biology can greatly advance our understanding of the natural world. The witnessingrole of spiders in terrestrial ecosystem has made them ecologically important. From past fewyearsthespidersarefacingnumberofthreatswhichhaveaffectedtheirpopulationsanddiversity.

Prior conservation programmes are required to protect this species from being morevulnerable andendangered.

Keywords:Spiders,terrestrialecosystem,ecosystemservices,conservation.Int

roduction

SpidersaremembersoftheorderArachnid, class Arachnida, and subclass Araneae.Thebiggestorderofarachnids,spidersarerankedseventhamongallothergroupingsoforganis msintermsofoverallspeciesdiversity(Cardoso,et.al.,2004).Spidersareamazing

animals; the fossil record shows that they first appeared as living things 380 million years ago,during the Devonian period (Garrison, et.al., 2016). Their two main body segments are thecephalothorax and abdomen;theformer has four pairs of segmented appendages, is wingless,andlackschewingmouthparts.Spiderswererecognizedbytheirdistinctiveabilitytoproducesilk thread. Although many spiders are incapable of spinning webs, all spiders are capable ofproducing silk thread, which they employ to form sacs to hold eggs, build nests, and, most often,wrap prey. They make up a substantial percentage of the terrestrial arthropod diversity. Spiderdiversity can be beneficial for biological control since different species have different huntingtactics, preferred habitats, and activity cycles(Cotes, et.al., 2018). In reaction to concentrationsofprey,spidersshowbothfunctionalandnumericalresponses.Spidersareubiquitousindistribution and invade almost every type of habitat, and are themost abundant invertebratepredators in terrestrial ecosystems. Nearly 47,617 species of spiders under 4,092 genera in 114families were recorded in the world (Mohan, 2019). There are 1520 known species of spiders inIndia, categorized into 377 genera and 60 families (Dharmaraj, et.al., 2017). One of the mostdiverse and widespread orders of arthropods in the world is the spider. Among the Arthropoda,arachnids are a significant yet understudied category. Spiders are found as predators in

nearlyeverytypeofterrestrialecosystem,withtheexceptionofAntarctica,suchascaverns,tundra,high elevations, and intertidal zones (Platnick, 2020). The range of their abundance per squaremeter is 0.64 to 842 (Turnbul, 1973).They occupy a vast range of niches and, thanks to theiramazing diversity of predation techniques, they also serve as important predators that control themajority of the insect population. These characteristics give them a perfect model for communityassessmentsasextraterrestrialpredators.Withrespecttothisecosystemfunctioningofthespiders, they also have the ability to provide various other protective, regulative and culturalecosystem services. Its essential that these ecosystem services provided by the spiders should beproperly documented. The previous studies have focused on the predator functioning of thespiders, which have been documented for different ecosystems (Michalko,et.al., 2019). But it’sessential to report the other ecosystems functions of the spiders. Keeping in view the abovediscussion in the present study we have provided a brief description about the role of spiders interrestrial ecosystem. From past few years spiders have witnessed the drastic climatic changesandothernaturalclimates,whichhavethreatenedthespiderdiversity.Thusinthiscontext,the

conservation of the spiders is necessary. In the present study we have highlighted the priorconservationstrategiesfor thespiders.

Researchmethodology

The present study is a descriptive study, which uses secondary data to frame out the basicecosystem services provided by the spiders. The secondary data were collected from differentpublished research papers, review papers, short communications, reports, published PhD thesis,news papers, journals, magazines, blogs, websites, different publishers like Springer, Elsevier,etc. The data was collected and the literature related to the present study was screened and theresultswereformulated.

Results& discussion

Spiders are obligate predators, meaning they must obtain the energy needed to sustain life byeatingotheranimals(Coppari,et.al.,2024).Spiderscanpreyonavarietyoforganisms,including other spiders, vertebrates (rarely), and their most common prey type, insects. It isestimated that one spider can eat as many as 2000 insects in one year (Walker 2010). Asgeneralist consumers, many spiders play an important role in each of the communities they arefound in by regulating the density of organisms across multiple trophic levels (herbivores andpredators). When you combine their variety of food types and their sheer abundance, spiders areone of themostimportant invertebratepredatorsin manyecosystems.

Spiders can maintain a dynamic interaction of the ecological units in a micro level food web(Suzuki,et.al., 2023). In integrated crop pest management it can serve as an essential element(Nyffeler and Benz, 1987). They are efficient natural controller of many insect mediated diseaseslike malaria, dengue etc (Kwenti, 2017). Spiders being ecologically important are economicallybeneficial also. In pharmaceutical industries spider silk and venom are now very importantindustrial inputs (Wong, et.al., 2014). Spider silk being proteinaceous and antibacterial in naturewith very high tensile strength is not only helpful in spinning web, wrapping the prey, egg saccovering, medium of transportation or movement from one place to another but also for makingsurgical threads, bullet proof jackets and threads of musical instruments, while itsvenom isuseful as antidote in many ailments (Umarani and Umamaheswari, 2013). Abundance as well asdiversityof spidersisagood indicator ofthehealthof a particularecosystem.

Itis clearthat spiders haveimportant ecological roles in maintaining ahealthy andstablecommunity. Spiders also directly benefit humans by consuming prey items that are pests tohumans and thus reducing their abundance. Many of the insects that spiders eat are directly affecthumans,includingmosquitoes,apestthattransmitsdeadlydiseaseslikeWestNilevirus,malaria, dengue and yellow fever. While many spiders eat mosquitos that fly into their web , twospecies of jumping spiders, *Evarchaculicivora*and *Paracyrbawanlessi*, are known as "mosquitoterminators." Both of these species are specialist predators, each preferring to eat mosquitoesfrom different life stages (adult & nymph respectively; Jackson, et.al., 2014). Regardless of howmosquitoes are consumed, spiders that have this pest as a part of their diet directly reducenumbersof these pestsand have thepotentialto reducethe spread ofdisease.

There is an ancient proverb: "The enemy of my enemy is my friend." Agricultural pests directlyreduce crop yields by feeding on the plants, robbing their fruit/seed output that we harvest forfood.Spidersindirectlybenefithumansbyeatingofavarietyofpests,includingaphids,grasshoppers,leafhoppers,beetles,caterpillars(Maloneyetal.2003).Reductionsinpestabundance have led to decreased crop damage (Reichert & Bishop, 1984), which could helpincrease yields. Sadly, farmers spend billions of dollars on non-natural pesticides designed toreduce weeds and insect pests that have been shown to reduce the abundance of spiders in fields,a natural and thus environmentally friendly form of pest control (Maloney et al. 2003, Haughtonet al. 1999, Thomas & Jepson 1997), and could end up resulting in a pest resurgence (Tanaka etal. 2000).

Spiders are seen to be kind animals that bring wealth, happiness, and/or good fortune in manycultures around the world (Lake-Thom, 1997). Because they come from heaven above, Chinesepeople hold a great esteem for spiders and refer to them as "happiness spiders" or "good luckspiders." It's reported in India that at weddings, spiders are scattered like confetti! The spider wasregarded by the Egyptian goddess Neith as the "spinner" and "weaver" of fate. Spiders are thesubject of several mythology and folktales across the globe (Doniger, 2011). These are a fewconvictions:

- Youwill meetafriendthatdayifyoustepintoa spiderweb.
- Youwillbringrainifyoustepona spider.
- Evenifaspidermanagestogetintoyourpocket,moneywillalwaysbethere.

- Abride willbe happyifshediscoversa spideronherweddinggown.
- Anticipatecompanyifa spiderweavesa weboveryourdoor.
- Sunnyweatherisonthe wayasspidersbeginweavingtheirwebsbefore midday.

In the view of scientists and researchers, spiders have already established themselves as modelorganisms for research and education because of their ability as bio-indicators, biological controlagents, having high medicinal value, and architects (Gandy,2022). In the current era we find thatmany researchers are involved toprovevarious biological theories. Thus from this perspectivewe can highlight that thespidersplayapivotaleducationalrole.

The above discussion has cleared that how spiders play an important regulatory, protective, andcultural role in a terrestrial ecosystem. From past few years it has been reported that the spiderpopulation across the globe, is under threat(Samu, 2023). Many species of spiders are extinct,are facing vulnerability, and many species are endangered due to various factors. The majorreasonsof spider threatsaregiven asunder;

- Climatechange
- Habitatdestruction
- Useofpesticidesinagriculturalecosystems
- Environmentalpollution
- Introductionofinvasivespecies
- Habitatshiftsandecoslips
- Negativepeopleperception
- Lackofpeople awareness
- Overgrazinganddeforestation

Recent data raises the possibility that local and global spider populations are falling, endangeringthe viability of the ecological services that spiders offer. Since the Neotropics are home to someof the world's hotspots for spider diversity and endemism, losses in the species are especiallyconcerning. One strategy to stop and lessen spider reductions is through conservation legislation,however they are typically skewed in favor of vertebrate species. Here, we address the possiblebenefits and drawbacks of many important policy tools for the protection of spider biodiversity.Theseincludesectoralpolicies,biodiversityoffsetting,market-basedmechanisms,protected

areasandIndigenousandCommunityConservedAreas(ICCAs),species-specificactionprograms, and the international policy instruments that support these initiatives. While thesepolicies may indirectly increase the variety of spider species, there are ways to better address theunique requirements of spiders in policy to slow down the reductions.Assessing the possibilityof extinction for additional spider species would enable policymakers to more effectively targetat-risk species and protect their habitats through area-based actions. Different approaches to pestmanagementandimprovedspidermonitoringacrosseveralland-basedproductionsectors.Incorporating into international agreements and conventions quantifiable and attainable goals forspider conservation. Lastly, the critical roles that increased public knowledge and communityinvolvementhadinaccomplishingtheseadvancementsinspiderconservationlaws.

Conclusion

Spiders have been a regarded as important species from ecological point of view. It has beenreported that the spiders provides different ecological services to the terrestrial ecosystem. Someof these services include; act as obligate predators, occupy a specific position in trophic levels offoodweb,havereportedhighmedicinalvalues,bearawidegenepool,seeddispersal,pollination, integrated pest management, educational value and cultural value. These ecologicalservices have made this species an important one. The spiders are facing serious threats fromdifferent factors. This has resulted the decrease in the spider population. Keeping in view thethreats to the spider population, prior conservation programmes are required to save this preciousspeciesontheearth.

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