

Insect biodiversity and ecosystem health



About Dr. Geetha Iyer

Iyer is a well-known science educator, writer, and naturalist with a strong focus on insects and biodiversity. She has made significant contributions to science communication in India and is widely appreciated for her ability to make complex ecological concepts accessible to general audiences.

She has authored books on insects and regularly writes educational articles that bridge scientific knowledge with everyday understanding. Her work emphasizes ecological literacy, biodiversity appreciation, and the critical role of insects in both natural and human-modified ecosystems.

Her most recent book, *Miniature Giants*, published by Penguin, explores the fascinating lives of insects and underscores their ecological significance in a rapidly changing world.

Interview

Question: Can you elaborate on the role of insect diversity in maintaining the health of agricultural and forest ecosystems?"?

Answer: The health of agricultural system vis-à-vis insects is dependent on agricultural practices. Aside from pollination, insects also have a role in maintaining soil health, nutrient recycling, habitat maintenance, and protection from pests. However these are directly related to the agricultural practices. It's a complex phenomenon, that the very insects that can help with growing and giving us healthy produces are being exterminated by processes adopted in the name of increasing the quantum of agricultural output. This complex network has its beginnings in an unstable human population explosion. To feed the ever-burgeoning human numbers, agricultural practices have turned chemical and technical to increase their produce. It is well documented – the pesticide use- that is resulting in the decline of insect diversity. Rather than elaborating on the role of insect diversity in maintaining the health of agricultural ecosystem, I would like to raise

a question – should we not be looking to see the status of insect diversity today? Take steps to conserve the insects that are still around and can serve us? For e.g., despite knowing that the bees are the foremost pollinators, have we managed to documented the bee species found in this country? Do we even encourage the use of indigenous species of honey bee in place of *Apis mellifera*? Pollinators, pest controllers, soil ploughers, nutrient producers and even pests and parasites to a certain extent have a role to play in maintaining the health of agricultural ecosystems. Forests! A different story here altogether. Insects in agricultural systems are better documented than those found in forests. At least this is what I have understood. Whenever I have tried to find the identity of matispids, ascaliphids, myrmeliontids, nemopterids, nymphids, hemerobiids or even chrysopids that I have either seen or photographed, it could not be done because there was no one studying them. Research papers from other countries tell me that they are all excellent at keeping a check on the population of insect species that could harm, damage trees in forests or even keep a check on population of ants that can otherwise over run a habitat with their large numbers. Acoustic monitoring that is being rapidly used in other countries is being studied by hardly a handful of researchers with Doctor Rohini Balakrishnan from IISc being one who is well known in this field. And she told me that the insects she used to hear earlier in the Kudremukh forests are no longer there. So when a question like this is asked , the image that comes to my mind is that of how in Tiger reserves, grasses and other plant species that are not eaten by herbivores (which are prey species for tigers) are razed to the ground to raise plants. that will attract tiger preys. Why can't at least a cursory survey of invertebrates not undertaken before interfering with the flora? What kind of conservation are we talking about? How can we accurately talk about the role of insects in forest ecosystems when there are not enough systematic records of insects from forests. Year after year we have tiger and elephant census, do we ever bother to survey the same area for insects? Individual researchers working on specific insect families/ genera are not given permission to survey in forests.

Even while working at the periphery of forests, researchers have noted that the population of dung beetles in the forest is in decline. The role of dung beetle in the forests is multifold. They are the clean up crew of the forest , turning the soil over, recycling nutrients, dispersing seeds, controlling specific species of flies, parasites etc; the larvae of the elephant dung beetle is favorite food for the bear. The ecosystem services of insects in forests cannot be completely detailed unless there is a conscious attempt to consider them as important species of the forest. That a tiger is a keystone species in a forest is an ecological concept that needs to be thrown out. They do not contribute to keeping a forest healthy as insects do. Their removal will not harm the forests which unfortunately the disappearance of insects will. Who will bell the cat? Raise a call for an inventory of insects and declare them as more important than tigers if forests have to survive?

Question: How do beneficial insects contribute to sustainable agricultural practices, and what are some key examples of such interactions?

Answer: If insects have to contribute then sustainable agricultural practices must remain true to the processes that can allow insects to flourish. In my mind all insects have some benefit or the other. For eg of the many ayurveda products that are plant based some at least have insect pests to thank for. Plants protect themselves from pests by producing chemicals which humans have found to contain medicinal properties. Quinine is a classic example. Azadirachtin from Neem is now a household name. Historically even strychnine was used by Ayurvedic and Unani practitioners. So while insects such as lacewings, reduviids, wasps, braconids, coccinellids, mantids, dragonflies etc serve to control pests and insect populations, species of bees, flies, and lepidopterans to name a few help in pollination. Insects that are soil dependent contribute too. The plant-insect relationship evolved over eons and is probably the most unique relationship in the world of nature. So careful cultivation of insect species, something that has perhaps not been given as much attention is key to agricultural practices becoming truly sustainable.

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Question: In your book, you explore the fascinating world of insects through storytelling. How do you see the role of such narratives in connecting scientific research with broader audiences?

Answer: Story telling is the oldest method of sharing knowledge with the young and old alike. Who does not like an interesting story especially when it turns a familiar idea, in this case, of insects, on its head? If you have to present the fascinating world of insects to humans, then boxing them as beneficial or harmful, with examples from scientific research is the best way to drive all interests away. Especially if you begin with their binomial names and technical body parts and functions. How do you overturn these images and bring to life for eg., the harmless and beautiful braconid wasp, delicate lacewing whose eggs have a stalk, of a fly that looks like a thread waisted wasp, or of a moth whose wings are a canvas of fascinating scenes of insect life? Only through stories. Researchers discover and explain in scientific terms and processes, as they must; story tellers turn them into an appreciable form that can easily be imagined; then the images of insects and the lives they lead will be that of a colourful and interesting world. For eg., tiger moth species are helping to create noise cancelling headphone. Headphones with mobiles are like “kavach and kundal” to modern day generation. A story about this will immediately garner attention and the idea of moths as pests of clothes or grains will disappear forever. Insects are misunderstood because no one has bothered to talk about them in a simple and interesting manner.

Question: In forest ecosystems, insects are integral to maintaining biodiversity. Could you discuss the various ways in which insect species contribute to the health and resilience of these habitats?

Answer: I remember reading in a paper published about insects in Forest Ecosystems that a destructive insect epidemic in forests is indicative of a forest health problem, not an insect problem. Pests could be indicative of a tree that is not healthy and by killing the weak trees the insect is opening out the forests for sunshine to penetrate to the soil floor allowing the new saplings to grow. The felled tree also becomes the habitat for a variety of organisms. Nutrients stored in the wood has to be made available for other organisms. The wood

is so hard that microorganisms are not capable of breaking down a huge tree. It is the work of insects along with fungi to break down the wood and recycle the materials. A lot of this work is done by the beetles. Deadwood is systematically removed by a posse of beetles that feed on its various parts by succession. Longhorn beetles, jewel beetles, wood wasps are the pioneers. In the next phase the stag beetles, click beetles, and darkling beetles take over. The flies and midges would occupy the little tunnels or mulms that result due to the beetle activity. And in the final phase there is a posse of insects from ants, springtails, fly maggots and many more. The rhinocerous beetles love to live among mulms. So much of the maintenance of the forest ecosystem is thanks to insects not the large mammals which most policy makers think are the best for forests.

Question: Reflecting on your own childhood experiences, how do you believe early exposure to insects can help cultivate curiosity and passion for insect conservation among young learners?"

Answer: *Frankly my childhood experience was nothing that presented insects in any positive manner. Squash the cockroach, swat the mosquitoes and fly, beat the life out of any insect that came into the house, was my grandmother's motto. I really learned to understand and appreciate insects only after I began teaching Biology to middle and high school students.*

I firmly believe insects can fascinate children and they should be introduced from a young age. As a teacher I have noted that watching them outdoors helped my students develop their observation and reasoning skills. The way the world is moving to everything artificial, insects are the answer to bringing children back to the natural. From insects they will soon move to frogs, lizards or birds - to the world of nature. My 8 year old grandson who lives in Chennai, looks forward to his visit to my house in Suchindram, because he can chase butterflies, hop skip and run away from ants and spiders, wonder at the way dragonflies swarm over the terrace and get excited to see the carpenter bee make a hole in the wooden pole. The gentle, harmless, butterflies can always be the beginnings of a child's tryst with nature. It is the first step to sowing the seeds of love for nature in her many avatars.

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