



**Biotica
Research
Today**
Vol 3:9 ⁷⁸⁴
2021 ⁷⁸⁵

Dung Beetles

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 Open Access

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Keywords

Beetles, Dung rollers, Saprophages, Scarabaeidae

Article History

Received in 15th September 2021
Received in revised form 19th September 2021
Accepted in final form 20th September 2021

E-mail: bioticapublications@gmail.com

How to cite this article?

Pradeepa *et al.*, 2021. Dung Beetles. Biotica Research Today 3(9): 784-785.

Abstract

The dead bodies of plants and animals are a rich source of organic matter that provides nutrition for many insects called saprophages. The suborder Scarabaeinae has coprophagy as a characteristic of most of its species. Dung rollers are one of the important insect saprophages that decomposes the waste. They derive their nutrients largely by eating microbes or colloids suspended in dung. This article explains the role of dung beetles in the functioning of the ecosystems.

Introduction

Dung rollers/ dung beetles belong to the Superfamily Scarabaeoidea. There are more than 27,800 species of scarab beetles in the world; about 1,700 occur in the Nearctic, Out of which, nearly 10 per cent species are found in India (Thomas, 2004). Although they are found all over India in various forms, they are best seen in dry and semi-dry habitats. Dung beetles belong to the order Coleoptera and have forewings that are hardened into hard sheaths called elytra. This protects the softer hind wings and the abdomen and gives them the advantage to survive in various habitats.

Functionally, dung beetles are divided into three broad categories based on the way they collect and store the brood mass.

- **Teleocorids or rollers:** The beetle makes a sphere from the dung pat or the dung pellets and rolls it away, usually with its hind legs and buries it in the soil and lays one egg.
- **Paracorids or tunnellers:** The beetle digs a tunnel at the bottom of the dung pat and breaks bits of the dung pat with its head, front legs and body and takes it through the tunnel where it stocks it up end to end to form a compacted brood mass. One egg is laid inside the brood mass. The beetles then place a layer of soil on the brood mass before starting the next one.
- **Endocorids or dwellers:** They construct brood masses in cavities of the dung pat itself.

In ancient Egypt the Scarab beetle (dung rollers) was believed to be a symbol of heavenly cycle and represented the idea of rebirth or regeneration. As the Scarab beetle rolls the dung into a ball and uses it for laying eggs, it is related with the Sun god Ra who used to roll across the sky each day transforming bodies and souls. The statue of Khepri (man with a scarab beetle head) was found almost in all the Egyptian temples.

Dung Rollers

Males of many scarabs bear spectacular horns on the head and/or pronotum with which they battle each other for females. Scarab beetles have extremely diverse feeding habits. Many feed on dung of mammals, some

being extremely specific on the kind of dung they will accept. Dung beetles provision burrows with dung for their larvae, some rolling balls of dung away for burying and sculpting the dung ball into special shapes. Some even tend the dung to prevent the growth of mold on it. Many others feed in soil, humus, and decaying wood. They are attracted to fresh dung via volatiles. The dung beetles make balls of dung from the dung pat to make a “brood mass”. Eggs are laid inside the brood masses. The larvae feed on the dung supplied by their parents in a nest chamber.

Parental Care

Parental care may exist in the form of guarding the burrow, or provisioning the young. In the dung beetles, male and female pairs dig out a burrow and then pack the end of it with a ball of fresh dung (some collect the dung first, tap it into a ball and push it with the hind legs to a desirable location where they then cover it with dirt). An egg is laid on the ball of dung, or the ball may be subdivided a number of times and eggs laid on each of the balls. In some species, there is little parental care, while in others, the burrow is defended and the dung ball is kept from desiccating and molding. After hatching from the eggs, the young feed on the dung within the protective environment of the burrow.

Scavenging

The benefit of dung beetles is perhaps best seen in Australia, a continent that lacked mammals (and mammal dung) until cattle were introduced during settlement by Europeans in 1788. The abundance of cattle in Australia (about 20 million) produces an abundance of dung that is slow to decompose, which allows bush fly, *Musca vetustissima* Walker (Diptera: Muscidae), to breed in huge numbers in the dung. Marsupial dung, the natural food source of bush fly, is much smaller and tends to dry out quickly and become unsuitable for fly larvae. To deal with the reduction in pasture by the slowly decomposing dung, and to reduce fly breeding, many species of dung beetles from Africa and Europe were introduced. The result has been an 80% reduction of bush flies. This approach has only recently been extended to target dog dung, a problem in urban areas (Capinera, 2008).

Orientation

The dung beetles use the night sky, specifically the Milky Way, to navigate and orient themselves. It was known before that the beetles and other insects and birds use the symmetrical pattern of the polarized light that appears

around the sun. These patterns are visible to the insects because they have special photoreceptors in their eyes. For night-time navigation, it was assumed that they use the faint light of the moon, but these dung beetles rolled the ball in a straight line even on moonless nights.

The study results showed that the beetles could orient themselves under a full starlit sky as well as when only the Milky Way was present. When the scientists put little cardboard hats on the study beetles' heads, thereby blocking their view of the sky, the beetles just rolled around aimlessly (Dacke et al., 2013).

Importance of Dung Rollers

One aspect of decomposition that has been studied is consumption of dung by insects, particularly by dung beetles (Scarabaeidae: Scarabaeinae). Cattle produce large quantities of dung, about 9,000 kg (about 21 cubic meters) per animal per year. Scarab beetles are quite efficient at decomposing this waste, which otherwise smothers vegetation, fouls vegetation leading to avoidance by grazing animals, and ties up nitrogen in an unusable form. Decomposition also reduces the breeding of parasites and nuisance and biting flies that would otherwise breed in the dung. The accelerated decomposition of dung by dung beetles in the USA is estimated to provide at least \$ 380 million in benefits annually (2006 estimate) (Capinera, 2008).

Conclusion

The benefits of dung beetles in the ecosystem services such as decomposition of dung, nutrient cycling, reduction of flies and parasites, seed dispersal is prominent. Many dung beetles control insect pests, and recent studies prove that their tunnels may even help in reducing greenhouse gas emissions. With the distribution of dung in the form of balls, dung holes, and tunnels, they keep the farmland fertile.

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