Fascinating world of Singing Caterpillars

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Abstract: Butterflies are one of the most beautiful as well as mesmerizing creatures on earth, comprising nearly 17,500 species around the world. They belong to the order Lepidoptera in the superorder Endopterygota. They undergo complete metamorphosis (Holometabola) consisting of egg, larval (caterpillar), pupal and adult stages. In the life cycle of butterfly, immature larva and pupa are the most vulnerable stages to natural enemies. They are eaten by various insects and non-arthropod predators. Therefore, different species of caterpillars have evolved with diversified defence strategies, such as hiding, camouflage, warning coloration, fleeing and deceiving to avoid predation. Interestingly, some of them have symbiotic association with ants to escape from their enemies. This phenomenon is more evident in singing caterpillars.

Key words: Symbiosis, association, singing caterpillar, Lycaenidae, Riodinidae.

What is symbiosis?

German botanist and biologist, A. B. Frank coined the term symbiosis in 1887. It comes from two Greek words that mean “with” and “living”. In 1879, a well known German mycologist Anton de Bary defined symbiosis as "the living together of unlike organisms". It is a kind of association between organisms of two or more different species which live in close organization, where one or both associated organisms are benefited. Each member in a symbiosis is termed as ‘symbiont’. If both the symbionts are benefited in an association, then it is called as ‘mutualism’. Some caterpillars belonging to Lycaenidae and Riodinidae families have evolved mutualistic relationship with many ant species.

Diversity of Lycaenidae and Riodinidae

Butterflies are grouped into six families namely, Papilionidae, Lycaenidae, Nymphalidae, Pieridae, Hesperiidae, and Riodinidae. Among them, Lycaenidae is the second largest family comprising nearly 6,000 species of butterflies including blues, coppers, hairstreaks and harvesters. Riodinidae constitutes nearly 1,500 species including metalmark butterflies. Majority of the species belonging to these two families are called ‘singing caterpillars’.

Why they are called singing caterpillars?

Caterpillars and pupae of some Lycaenidae and Riodinidae families produce substrate borne vibrations to call ants for their protection from predators and parasitoids. Caterpillars not only use chemical signals produced by myrmecophilous secretary organs such as pore cupola (present on skin of caterpillars), tentacles (present on the eighth abdominal segment of Lycaenidae and Rionididae), and dorsal nectary glands (located on the dorsum of the seventh abdominal segment of Lycaenidae) as mode

of communication with ants, but also produce substrate vibrations through non secretary organs. These substrate vibrations resemble acoustic sound, which helps in attracting ants. Hence the name, "singing caterpillars." The term singing caterpillars was coined in 1997 by tropical biologist Philip James DeVries.

Fig. 1. *Oecophylla smaragdina* attending *Zesius chrysomallus* (Lycaenidae) caterpillar (Photo credit: Ashley Shaji)

Organs associated with sound production

Caterpillars of Lycaenidae start producing characteristic sound from the beginning of third instar. The organ of sound production within the family is poorly understood. They produce low amplitude, substrate borne sounds to call ants. In most of the cases, calls are similar to that of slow drumming sound. Pupae produce sound by stridulation of file and scraper found in inter segmental region of abdominal segments 4 - 5, 5 - 6 and 6 - 7.

In case of caterpillars of Riodinidae, a pair of specialized non secretary organs, vibratory papillae is present on the distal edge of prothorax. Throughout the length of these vibratory papillae distinct concentric grooves can be marked. Whenever caterpillar oscillates head, epicranial granulations present on head region slip across the concentric grooves, producing low amplitude sounds. Pupae produce calls by stridulation of two set of file and scraper, which are present between 4th and 5th, 5th and 6th abdominal segments.

Caterpillar- ant association

According to the studies, association of Riodinidae and Lycaenidae caterpillars with ants is very important for their successful completion of life journey without which the survival of caterpillars is very rare. Hence, it is crucial for caterpillars to maintain symbiotic relationship with ants as guards against their natural enemies. Caterpillars attract ants by offering amino acids and sugar secretions as food source. Ants attend these caterpillars to collect the secretions and their presence deters natural enemies from caterpillars. As a result, caterpillars of Lycaenidae and Riodinidae get protection. A list of a few singing caterpillars associated with ant species is enclosed in Table 1.

Conclusion

The association of singing caterpillars with ants has become a lifesaving strategy. The associated ants make the life of these caterpillars easier by protecting them from their natural enemies. While ants, in turn, get sugary honeydew secreted by singing caterpillars as a supplementary food source.

References

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Table 1. Examples of few singing caterpillars associated with ant species

Caterpillar	Associated ants	Reference
Riodinidae		
Eurybia elvina *Alesa amesis*	*Brachymyrmex musculus,* *Paratrechia sp.,* *Pheidole gouldi,* *Solenopsis geminate*, *Wasmannia auropunctata*, *Crematogaster sumichrasti Camponotus femoratus*	Horvitz *et al*., 2016
Cupido minimu	*Myrmica schencki* *Lasius niger*, *Myrmica rubra*	Emmet and Heath, 1990
Lycaenidae		
Cigaritis zohra	*Crematogaster laestrygon*	Rojo, 1990
Cigaritis ardilla	*Crematogaster auberti* *C. antaris* *C. scutellaris*	
Cigaritis myrmecophila	*Crematogaster auberti*	Hinton, 1951
Lycaena dispar	*Myrmica rubra*	
Lampides boeticus	*Lasius niger*	
Thecla betulae	*Lasius niger*	Emmet and Heath, 1990
Quercusia quercus	*Lasius sp.*	Kitching and Luke, 1985
Tomares ballus	*Plagiolepis pygmaea*	Chapman and Buxton, 1919
Satyrium ilicis	*Camponotus aethiops*	Malicky, 1969
Satyrium esculi	*Camponotus cruentatus*	Martin and Gurrea, 1983

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