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Ramya N
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Padala Vinod Kumar
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Keerthi MC
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Srinivasa N
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Ramesh KB
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Correspondence
Padala Vinod Kumar
ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

Aggressive mimicry: A potential tool of Predators

Ramya N, Padala Vinod Kumar, Keerthi MC, Srinivasa N and Ramesh KB

Abstract
Mimicry is a similarity of one organism to another. Generally mimicry evolved to defend against the predators. But one form of mimicry adopted by some predators to attract and attack their prey is Aggressive mimicry. Aggressive mimicry is a form of mimicry in which predators, parasites or parasitoids share similar signals with a harmless model, to avoid being correctly identified by their prey or host. In this type of mimicry predator, parasite or pasasitoid mimic the different signals of its prey perception that may be food, sexual signals mutualistic species or prey itself. It is classified into different types based on the luring, number of species and taxa involved, based on model, *etc.* The success of this mimicry depends on the active planning, decision-making and flexibility of the mimic. Sexual signals mimicking by the predators are highly specific than the other signals. Research on aggressive mimicry holds exceptional potential for advancing our understanding of insect communication cognition which is having greater importance in insect ecology and in addition aids in speciation studies.

Keywords: Aggressive mimicry, a potential tool of Predators

Introduction
Mimicry is the similarity or resemblance of one organism, to another. Mimicry may evolve between different species, or between individuals of the same species [1]. Generally mimicry evolves to protect itself from predators. The resemblances that evolve in mimicry can be in appearance, behavior, sound, or smell. Mimicry is mutualism where it may be advantage of both organisms that share a resemblance or mimicry can be disadvantage to one, making it parasitic or a prey [2]. Word mimicry dates back to 1637. It derives from the Greek term *mimetikos*, "imitative", in turn from *mimetos*, the verbal adjective of *mimeisthai*, "to imitate". Originally used to describe people, "mimetic" was used in zoology from 1851, word "mimicry" in use from 1861.
Many types of mimicry as follows, emphasizing the similarities and the differences between the various forms.

Defensive or protective mimicry
Defensive or protective mimicry takes place when organisms are able to avoid their predators. 1. Batesian mimicry - where a harmless organism mimics a harmful organism to predators, to be get avoided by them. 2. Mullerian mimicry - where two or more harmful species mutually advertise themselves as harmful. 3. Mertensian mimicry - where a deadly mimic resembles a less harmful but lesson-teaching model. Another important type of mimicry used by some predators to attract their prey is.

Aggressive mimicry
Aggressive mimicry is found in predators or parasites that resembles as a harmless species, allowing them to avoid detection by their prey or host. The mimic may resemble the prey or host itself, or another organism that is either neutral or beneficial to the prey [3].
The term Aggressive mimicry first coined by Poulton 1890, he defined it as “one animal resembling another in order to approach it without exiting suspicion”. Or it can aslo be defined as “Aggressive mimicry is a form of mimicry in which predators, parasites or parasitoids share similar signals with a harmless model, allowing them to avoid being correctly identified by their prey or host.”
Aggressive mimicry basically differs from other forms of mimicry. In this class of mimicry, the model may be affected negatively, positively or not at al. [4] Aggressive mimicry is opposite in principle to defensive mimicry where the mimic generally benefits from being treated as harmful. The mimic may resemble its own prey, or some other organism which is beneficial or at least not harmful to the prey.

The model, i.e. the organism being 'imitated', may experience increased or reduced fitness, or may not be affected at all by the relationship. Aggressive mimicry in contrast to defensive mimicry because of these reasons

- Model may be adversely affected directly or indirectly.
- Mimicking is mainly to attract and attack the prey not for the defence purpose
- Predator adapt many signals of the model both morphological as well as behavioral signals

Aggressive mimicry classified into different types based on the luring, no. of species and taxa involved, Based on Model *etc.* Based on luring: a. Food luring, b. Mate signals. Based on no. of species involved: a. Intraspecific b. Interspecific or intertaxa. Based on Model: a. Mimic host b. Mimic host prey

Aggressive mimicry classified based on luring the prey

In some cases the signal receiver is lured towards the mimic. This involves mimicry of a resource that is often vital to the prey's survival such as nutrition, shelter or a mate.

Luring through food

Predator lure the prey through food colour mimic, food pattern mimic, mimic the food or prey of host itself. For instance predator lure the prey through food colour mimic: One case is the golden orb weaver (*Nephila clavipes*), which spins a eye-catching golden coloured web in well-lit areas and these webs shine due to sunlight. Since yellow is the colour of many nectar bearing flowers, bees and other pollinators get confused with the yellow appearing webs as flowers due to sunlight. Then the bees attracted and get trapped inside the web [5]. Predator lure the prey through Food pattern mimic is another form of mimicry is based not on color but pattern. Species such as *Argiope argentata* employ noticeable designs in the middle of their webs, such as zigzags. These patterns reflect ultraviolet light, and mimic the pattern seen in many flowers known as nectar guides. So the nectar seeking bees get trapped inside the webs and become the prey for spiders. In order to attract the bees to webs, spiders need to change their web pattern and place day to day otherwise spider suffer diminishing prey capture, because the bees remember the web patterns and may not attracted to these webs again [6].

Spiders can also be the prey of aggressive mimics. For instance the assassin bug *Stenolemus bituberus* thread-legged insect (Emesinae) preys on spiders. These bugs lay their eggs near to the spider webs [7]. The emerging nymph entering their web and plucking its silk threads until the spider approaches it. This vibrational aggressive mimicry matches a general pattern of vibrations which spiders think as prey, which having a similar chronological structure and amplitude to leg and body movements of specific prey caught in the web. When stalking, they slowly approach the spider until the spider reach within striking range of bug and they lure the spider by plucking the silk threads of the web. The prey caught in the spider webs make some movements like wing beating, moving head and thorax, pulling leg etc, which generate lower frequency and amplitude vibrations. To the spider, the vibrations generated by bugs may bear a resemblance to small or exhausted prey movements. So the spider try to reach near its prey but it become fool and prey for the bug [8].

Bipolar aggressive mimicry

Mimicry involving only two species are known as bipolar mimicry. Only one bipolar arrangement is possible here: that is where the host or prey itself is the model. There are two types of mimic imitating its target, in the first case, termed Batesian-Wallacian mimicry where the model is the prey species. Similarly, in the second case model is the host of a brood parasite. These are, 1. Batesian-Wallacian mimicry, 2. Host mimicry by the mimic.

1. Batesian-Wallacian mimicry

In this type of mimicry different signals are used by the predators which are discussed here. Aggressive chemical mimicry using sex pheromone. For example the female bolas spider of the genus *Mastophora* produce referents of the moth flies (Diptera, true flies, but resembling moths) sex pheromones to lure male moth-flies. The spiders of family Psychodidae are specialized in producing sex pheromones of moth flies at species level. Juveniles of spider use their front pair of legs to capture flies which comes in their range but the older spiders use a different strategy. Adult spiders swing a sticky ball known as a bolas suspended by a silk thread at moths and attract them to predate on them [9].

Aggressive mimicry using light signals. Here Light signals with particular pattern is used for sexual communication in fireflies these signals are abused by the predatory fireflies to invite the prey. Here model is the sexually receptive female. Lightning bugs (*Lampiridae*) have specific flash pattern to find each other. Females of the genus *Photurus* fireflies imitate the flash sequence of the *Photunis* females to lure the *Photinus* males to within graspable range. They then attack upon the males and devour them. The *Photuris* females also sequester the defensive chemical lucibufagin from the *Photinus* prey, to obtain protection against spiders and it also used to protect their eggs [10].

Acoustic aggressive mimicry: Some insect species use acoustic signals in intraspecific communication, these signals are exploited by some insect preadators to attract their prey. For instance the listroscelidine katydid *Chlorobalius leucoviridis* of inland Australia attract the male cicadas of the Tribe Cicadettini through acoustic signals. The acoustic signals here are species-specific reply clicks of sexually receptive female cicadas to attract male cicadas. *C. leucoviridis* attract males of many cicada species by mimicking the reply clicks of the female cicadas. In this cicada species the reply clicks produced by the females is recognized by precise timing in relation to male mating song, this timing of song exploited by the mimic *C. leucoviridis* to evolve acoustic aggressive mimicry. The katydid clicks closely resemble female wing flicks in sound content and timing. When cicada began to sing, one or more katydids initiate responding, with many clicks following male song cues. The male cicada then turned towards reply clicks and began walking and/or flying towards a replying katydid. Once the cicada came within reach, the katydid trapped it with its fore and often midlegs and downcast it by partially biting off the head, a behavior common to many predatory orthopterans [11].

2. Host mimicry by aggressive mimics

Predator or Parasite mimics its own host to get protection against their predators and predate on the model. As with mimicry of the female sex delineated previously, only two species are involved. Brood parasitism is a type of kleptoparasitism, where the mother has its offspring raised by another unsuspecting organism, is one such situation where host-parasite mimicry has evolved. Some of this type of agressive mimicry discussed below.

Exploiting social behavior: the aggressive mimics often use

both morphological resemblance as well as behavioral tactics to attract and prey on the models. For example, the thomisid, *Amyciaea forticeps* adopts the alarm attitude of its model (abdomen and antennae raised). This apparently attracts workers of the model, *Oecophylla* sp. (which have good eyesight). When an ant approaches, the spider attacks it. Another example is the aphantochilid, *Bucranium* sp., which carries dead ants of the genus *Cephalotes aloft*, conceivably as a mimetic device to attract attention other ants. Once the ant species came near the predatory thomisid it attack and devour it [12].

Wicklerian-Eisnerian aggressive mimicry

This type of mimicry involves the mimic resembling a species that is an important partner of the prey or host. For instance a species of cleaner fish and its mimic, in this example the model is greatly deprived by the presence of the mimic. Cleaner fish are the helpers of many other species, which eat and clean their parasites and dead skin like symbiotic mechanism. Some species allow the cleaner fish to enter even inside their body to hunt the parasites. For instance H one species of cleaner, the bluestreak cleaner wrasse (*Labroides dimidiatus*), is the model of a mimetic species, the sabre-toothed blenny (*Aspidontus taeniatus*). The cleaner wrasse clean a grouper of the genus *Epinephelus*, exist in in coral reefs in the Indian and the Pacific Oceans. The cleaner is recognized by other fishes by its colour, size and a form of dance. Mimetic species mimic these characters of the cleaner and fooling its prey to allowing it enter inside prey body. Once the mimetic species enter into it starts biting it, tearing off a piece of its fin before absconding the scene [13].

Aversive stimuli aggressive mimicry

Aggressive mimicry can also be based on simulating stimuli that are aversive to prey. The Painted redstarts, insectivorous birds demonstrate aggressive mimicry that adopt a strategy of flushing small flies out of hiding. They spread and twist their tails and wings, thereby creating aversive stimuli to which the flies respond by fleeing. Unfortunately while moving away from the redstart's tail and wings flies enter the foveal field of view of the redstart's eyes where they become easy targets for the predator [14].

Intraspecific aggressive mimicry

Aggressive mimicry occurs within the species called intraspecific aggressive mimicry. Where coutership and predatory approaches have a way of running together and either sex may kill and eat the other. The spider species *Portia labiate* express this type of aggressive mimicry. The sub adult females (i.e. juveniles that are one moult short of maturity) are similar in size and appearence to adult *P. labiata* females but they are incapable of mating, yet, like adult females, they actively exhibit themselves at conspecific males. The male responds by entering the web, and pose for courting and mounting. While the male is on board, the subadult drops on a thread and performs pseudo-copulation and easily make predatory attack to catch the male [15].

Factors affecting aggressive-mimicry strategies

Number of factors such affect the aggressive mimicry including prey and predator, these are Cognitive predatory strategies like active decision-making, planning and flexibility of mimetic species in performing the mimicry, Neural processors accomplished of deducing complex signals and retort patterns, Evolution of organism to adopt and manipulate itself for mimicry, Selection pressure and evolutionary history also play an important role [16].

Conclusion

By studying all these cases and examples one can come to conclusion about the aggressive mimicry that, aggressive mimics, exploiting sexual signals, are highly specific bearing close resemblance to a readily identifiable model than the other which are general. It helps in deriving the dual benefit of protection as well chance for predation by the predator. Investment of energy is very less by the predator compare to benefit it derive from mimicry. Research on aggressive mimicry holds exceptional potential for advancing our understanding of insect communication cognition and aggressive mimicry has greater importance in insect ecology and helps in speciation studies.

References

1. Smith D, Harper J, David. Animal signals. Oxford University Press, 2007, 86-87.
2. Wickler W. Mimicry in plants and animals. McGraw-Hill, New York. 1968, 67-69.
3. Wickler, Wolfgang. Mimicry and the evolution of animal communication. Nature**.** 1965; 208(5010):519-21.
4. Carl W. Rettenmeyer. Insect Mimicry. Annual Review of Entomology. 1970; 15:43-74.
5. Jackson RR. Eight-legged tricksters: Spiders that specialize at catching other spiders and insects. Bio Science, 1995; 42:590-98.
6. Craig CL. Webs of Deceit. Natural History, 1995; 104(3):32-35.
7. Wignall AE, Taylor PW. Biology and life history of the araneophagic assassin bug *Stenolemus bituberus* including a morphometric analysis of the instars (Heteroptera, Reduviidae). Journal of Natural History. 2008; 42:59-76.
8. Wignall AE, Taylor PW. Assassin bug uses aggressive mimicry to lure spider prey. Proceedings of the Royal Society. 2011; 278:1427-1433.
9. Yeargan KV, Quate. Juvenile bolas spiders attract psychodid flies. Oecologia, 1996; 106(2):266-271.
10. Lloyd JE. Aggressive mimicry in Photuris: firefly femmes fatales. Science, 1965; 149(3684):653-654.
11. Marshall DC, Hill KBR. Versatile aggressive mimicry of cicadas by an Australian predatory katydid. Plos One, 2009; 4(1):4185-4199.
12. Mclver. James and Gary Stonedahl. Myrmecomorphy. Encyclopedia of Entomology. Springer Netherlands, 2008, 2532-2537.
13. Wickler W. Mimicry in Tropical Fishe. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 1996; 251(772):473-474.
14. Jablonski PG, Strausfeld NJ. Exploitation of an ancient escape circuit by an avian predator: prey sensitivity to model of predator. Brain, Behavioral Evolution, 2000; 56:94-106.
15. Jackson RR, Hallas SEA. Comparative biology of *Portia africana*, *P. albimana*, *P. fimbriata*, *P. labiate* and *P. schultzi*, araneophagic, web-building jumping spiders (Araneae: Salticidae): utilisation of webs, predatory versatility, and intraspecific interactions. Journal of Zoology. 1986; 13:423-489.
16. Robert R, Jackson G, Fiona RA. Cognitive perspective on aggressive mimicry. Journal of Zoology. 2013; 290(3):161-171.