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Mimic Pollination in Ornamental Plants

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A B S T R A C T

Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. Mimicry in plants is where a plant organism evolves to resemble another organism physically or chemically, increasing the mimic's Darwinian fitness. Mimicry in plants has been studied far less than mimicry in animals, with fewer documented cases and peer-reviewed studies. It may provide protection against herbivory, or may deceptively encourage mutualists, like pollinators, to provide a service without offering a reward in return. Pollination is a very important part of the life cycle of plants. Insects, birds, bats and the wind take pollen between flowering plants, which means the plants can make seeds and reproduce. Its significance is to carry the pollen grains to the stigma for the process of fertilisation.

Introduction

Mimicry in plants

Mimicry in plants is where a plant organism evolves to resemble another organism physically or chemically, increasing the mimic's Darwinian fitness. Mimicry in plants has been studied far less than mimicry in animals, with fewer documented cases and peer-reviewed studies. It may provide protection against herbivory, or may deceptively encourage mutualists, like pollinators, to provide a service without offering a reward in return (1,2,3).

Advantages of mimicry plants

It attracts the pollinators

Escape the predation from herbivores

It maintains the diversity

Mimic plants will maintain the descendents characters

Pseudocopulation increase pollination capacity

Mimic in plants is a vivid demonstration of natural selection as a guiding force in evolutionary change (4-6).

Uses of mimicry

Mutualism

1. Friendly mutualism

Here help each other, both benefit and no one is harmed. No free lunch, but benefits higher than costs.

2. Antagonism

One benefits, another is harmed.

3. Commensalism

One benefits, another is unaffected.

Pollination systems

1. Attracting pollinators: visual cues

A "Bull's eye" color pattern(background of green foliage)	***Rudbeckia, a black-eyed susan***
A reversed bull's eye	day lily *Hemerocallis*
Human & butterfly	*Gaillardia,* painted daisy
Honey bee	orange/white flowers

2. Attracting pollinators: olfactory cues

Butterfly, Bird	**more visual in behaviour and not very olfactory**
Bees	sweet or spicy
Moth	very heady sweet fragrances
Bats	Strong fruity or musky scents

3. Attracting pollinators: shape

Beetle	**easy, open entrance, structural foods**
Hovering pollinators	generally hang down and have a long nectar tube
Non-hovering insects and birds	need perches or landing platforms as part of the flower
Mimicry of female	*Drakea spp.*

Pollination syndrome

Cantharophily	**Beetle pollination**	***I. atropurpurea***
Myophily	Fly pollination	Skunk cabbage lady-slipper orchid (*Cypripedium spp)*Alcohol produce
Phalaenophily	Moth pollination	*Gymnadenia conopsea* (Fragrant Orchid) Pollinated by Hummingbird Hawkmoth
Psychophily	Butter pollination	*Gaillardia*(painted daisy)
Melittophily	Bees pollination	Morning dew, Mectan sunflower
Obligate pollination		figs-fig wasps yuccas-yucca moths (*Tegeticula)*

Herbivory

1. Venus's fly trap

The two-lobbed trap: 3 trigger hairs on the inner face of each lobe, fringed with teeth-like projections. When one trigger hair is touched twice or when two are touched in succession, the trap closes. The teeth-like projections interlock, trapping the unsuspecting victim inside. The struggling victim stimulates the secretion of digestive juices. The trap reopens in about 10 days (7).

2. Sundew

More than 100 species of sundews (*Drosera*). Leaves are covered with tiny (usually red) hairs, which exude a clear, sticky fluid (dewdrops).The sticky droplets attract and trap insects. The struggling insect stimulates the hairs to bend inward towards the centre of the leaf, to wrap it in a neat, tight package.

3. Butterwort

Leaves with a very sticky surface. Greasy to the touch, but deadly to any small insect that may land on or try to cross one of the leaves.

4. Pitcher plants

Leaves or leave parts modified into pitcher-like structures. Pitchers contain plant juice that smells like sweet nectar and attracts insects. Pitchers are topped with a hood or lid. When insect try to drink from the pitcher, it loses its footing on the smooth interior, slides to the bottom, lands in a pool of liquid, which digests the victim.

Types of mimicry in plants

1. Bakerian
2. Dodsonian
3. Vavilovian
4. Pouyannian
5. Batesian
6. Cryptic

1. Bakerian

Bakerian mimicry, named after English naturalist Herbet Baker, is a form of *automimicry* or *intraspecific mimicry* that occurs within a single species. In plants, the female flowers, mimic male flowers of their own species, cheating pollinators out of a reward. This reproductive mimicry may not be readily apparent as members of the same species may still exhibit some degree of sexual dimorphism, i.e. the phenotypic difference between males and females of the same species.

Examples

It is common in many species of Caricaceae, a family of flowering plants in the family of Brassicaceae, found primarily in tropical regions of Central and South America, and Africa.

2. Dodsonian

Dodsonian mimicry, named after American botanist, orchidologist, and taxonomist, Calaway H. Dodson, is a form of reproductive floral mimicry, but the model belongs to a different species than the mimic. By providing similar sensory signals as the model flower, it can lure its pollinators. Like *Bakerian mimics*, no nectar is provided.

Examples

S.No	Crop	Resemble crop	Pollinators
1.	*Epidendrum ibaguense*	*Lantana camara* and *Asclepias curassavica*	Humming birds and Monarch butterfly
2.	*Cistus* spp.	*Ophrys* spp.	Lamellicorn beetle

Epidendrum ibaguense a species of epiphytic orchid of the genus. *Epidendrum* that occurs in Trinidad, French, Venezuela, Colombia, and Northern Brazil, resembles flowers of *Lantana camera* and *Asclepias curassavica* (commonly called Mexican butterfly weed, blood-flower, scarlet milkweed, or tropical milkweed), both are species of flowering plant with the first in the Verbena family, while the latter belongs to the milkweed family, and both are native to the American tropics. *Epidendrum ibaguense* is pollinated by Monarch butterfly (*Danaus plexippus*) and perhaps humming birds. Similar cases are seen in some other species of the same family.

The mimetic species may still have pollinators of its own though, for example a Lamellicorn beetle, which usually pollinates correspondingly coloured *Cistus spp.* flowers, is also known to aid in pollination of *Ophrys* spp. that are normally pollinated by bees (8).

3. Vavilovian

Vavilovian mimicry named after Russian plant geneticist who identified the centres of origin of cultivated plants, Nikolai Vavilov is a form of mimicry in plants where a weed comes to share one or more characteristics with a domesticated through generations of artificial selection. It is also known as crop mimicry or weed mimicry. Selection against the weed may occur by killing a young or adult weed, separating its seeds from those of the crop (winnowing), or both. This has been done manually since Neolithic times, and in more recent years by agricultural machinery.

Examples

Erigeron Canadensis (weed species) have same similar character inflorence a cultivated species of *Amaranthus palmeri*

Annual bluegrass is mowing tolerance capacity and used as Gulf course in foreign countries. It is suitable for temperate region. Creeping bent grass also express the same characters of Annual blue grass which is normally used as gulf course in now-a-days.

4. Pouyannian

Many plants have evolved to appear like other organisms, most commonly insects. This can have wide-ranging benefits including increasing pollination. The flowers mimic a potential female mate visually, but the key stimuli are often chemical and tactile.

Examples

The hammer orchid (*Drakaea* spp.) an endangered genus of orchid that is native to Australia is one of the most notable examples. The orchid has both visual and olfactory mimics of a female wasp to lure males to both deposit and pick up pollen.

The orchid *Epipactis helleborine* is physiologically and morphologically adapted to attract social wasps as their primary pollinators. Social wasps feed their larvae on insects like caterpillars. To locate that prey, they use a combination of visual and olfactory cues. The flowers of *E.helleborine* and *E. purpurata* emit green-leaf volatiles (GLVs), which are attractive to foragers of the social wasps *Vespula germanica* and *V.vulgaris*. Several *E. helleborine* GLVs that induced a response in the antennae of wasps were also emitted by cabbage leaves infested with caterpillars (*Pieris brassicae)*, which are common prey items for wasps. Despite a large nectar reward, the species is almost entirely overlooked by other pollinators.

Carrion flowers mimic the scent and appearance of rotting flesh to attract necrophagous (carrion-feeding) insects like flesh flies (Sarcophagidae), blowflies (Calliphoridae), house flies (Muscidae) and some beetles (e.g., Dermestidae and

Silphidae) which search for dead animals to use as brood sites. The decaying smell of the flower comes from oligosulfides, decayed proteins that contain amino acids methionine and cysteine. While carrion flowers do produce a small amount of nectar, this does not necessarily make its relationship to necrophagous insects mutualistic. Insects lay eggs on the carrion flowers, meaning they mistake them for oviposition sites. The nectar acts as a lure to bring the insects closer to the reproductive parts of the flower.

5. Batesian

Batesian mimicry is a form of mimicry, named after the English naturalist Henry Walter Bates, where a harmless species has evolved to imitate the warning signals of a harmful species directed at a predator.

Examples

Thorn mimicry of two types has been observed in plants. The first, a special case of intra-oranismic Batesian mimicry characteristic of Aloe spp. (Liliaceae), *W. filifera* (Palmaceae), and dozens of species of Agave, including *A. applanta, A. salmiana,* and *A. obscura*. These plants develop thorn-like imprints or colorations on the face of their leaves due to the teeth along the margins of that leaf (or another leaf) pressing sustained indentations into the flesh of the non-spiny parts.

The second type of thorn mimicry, a more classic case of Batesian mimicry, involves the pointed, colourful organs like buds, leaves and fruit of mimitic plant species that mimic aposematic colourful thorns not found anywhere else organism.

Several plants growing in Israel, Estonia, Greece, and Japan exhibit possible spider web mimicry. Dense, white *trichomes* spp. are produced on newly extended stems and leaves that deter herbivory due to predatory habit or toxicity. This may be a case of visual mimicry or perceptual exploitation. Case examples include the new buds of *Onopordum* spp. from Israel, *Carthamus sp*. from Greece, flower heads of *Articum tomentosum* from Estonia, a fledgling leaf of *Tussilago farfara* from Estonia, and new fronds of *Osmunda japonica* from Japan.

Difficult example for bucket orchid Pollination

The bucket orchid of Central America, is equipped with a small bucket structure behind the flower. The flower produces oil which drips into the “bucket” and attracts bees with its unique odour. Each bucket orchid species has its own scent, thus each attracts its own species of bee. When the male bees smells the perfume, it goes to the orchid to collect an oily substance which he will use to attract females (he is only attracted to one orchid species scent since he wants to attract only female species). However, often as he is collecting his oil, the bee falls into the bucket. The only way out is through a tube. The bees moves through a tube, getting “tagged” with orchid pollen, so when he visits the next flower he will pollinate it as he passes through its funnel (9-12).

6. Cryptic mimicry

In ecology, crypsis is an organism's ability to avoid detection by other organisms. Therefore, cryptic mimicry is a situation where a prey organism deceives a potential predator by providing false signals or a lack of signals. Cryptic mimicry in plants is usually achieved visually.

Example

The South American *Boquila trifoliata*, of the Lardizabalaceae family, is a climbing vine with a highly variable phenotype. It is capable

of mimicking the leaf features of plant species that it clings to, adopting colour shape and size. By camouflaging its leafy appendages, *Boquila* lowers its rate of herbivory.

References

1. *Disa pulchra*, and its consequences for pollinator behaviour, *Biological 3oumal ufthe Linnean S o c i e* (2000), *71:* 119-132.
2. Ernesto Gianoli, and Fernando Carrasco-Urra, (2014), Leaf Mimicry in a Climbing Plant
3. Gumbefu, A. and Kunze, J. (2001), Colour similarity to rewarding model plants affects pollination in a food deceptive orchid, *Orchis boryi*, *Biological Journal of the Linnean Society* (2001), 72: 419-433.
4. https://en.wikipedia.org/wiki/Batesian_mimicry.
5. Johnson, S. D. (1999), Batesian mimicry in the non-rewarding orchid
6. Nicolas J. Vereecken *et al.*, (2013), A pollinators' eye view of a shelter mimicry system, Annals of Botany 111: 1155–1165, 2013.
7. Paulette Bierzychudek, (2013), Asclepias, Lantana, and Epidendrum: A Floral Mimicry Complex? Biotropica, Vol. 13, No. 2, Supplement: Reproductive Botany (Jun., 1981), pp. 54-58.
8. Protects against Herbivory, Current Biology (2014), http://dx.doi.org/10.1016/j.cub.2014.03.010
9. Rod Peakall *et al.*, (2010), Pollinator specificity, floral odour chemistry and the phylogeny of Australian sexually deceptive Chiloglottis orchids: implications for pollinator-driven speciation, New Phytologist (2010) 188: 437–450.
10. Scott McElroy J, (2014), Vavilovian Mimicry: Nikolai Vavilov and His Little-Known Impact on Weed Science, Weed Science, 62(2):207-216. 2014.
11. Spencer C.H. Barret, (1987), Mimicry in plants, Scientific American (Sep 1987) VOL 255 NO.9.
12. *Stephen D. Hopper* A, C and Andrew P. Brown A revision of Australia s hammer orchids (*Drakaea*: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators, *Australian Systematic Botany* 20, 252–285.

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