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Two Little-known Selective Insect Attractants[1]

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(Plates I-IV)

[This paper is one of a series emanating from the tropical Field Station of the New York Zoological Society, at Simla, Arima Valley, Trinidad, British West Indies. This station was founded in 1950 by the Zoological Society's Department of Tropical Research, under the direction of Dr. William Beebe. It comprises 200 acres in the middle of the Northern Range, which includes large stretches of undisturbed government forest reserves. The laboratory of the station is intended for research in tropical ecology and in animal behavior. The altitude of the research area is 500 to 1,800 feet, with an annual rainfall of more than 100 inches.

[For further ecological details of meteorology and biotic zones see "Introduction to the Ecology of the Arima Valley, Trinidad, B.W.I.," William Beebe. (Zoologica, 1952, Vol. 37, No. 13, pp. 157-184).]

CONTENTS

I. INTRODUCTION

INSECT repellents have earned a generous representation in entomological study and literature, owing perhaps to their economic importance.

Attractants appertain rather to pure science and are more directly related to our studies of animal behavior. They are abundant in variety and varied in efficiency and, at the Zoological Society's station at Simla, Trinidad, B.W.I., are brought to our attention the moment we leave the laboratory. This will be evident from a few random examples.

Under odor we may mention tree-bait, with the old familiar mixture of such ingredients as molasses and beer, attractive more especially to moths at night; sexual odors, as the well-known drawing of males to a caged female from as far away as two to six miles; plant odors, operating sometimes indirectly, as when an adult butterfly oviposits on a larval food-plant. Finally, we have the olfactory focus of over-ripe fruit or decaying mouse which influences a whole complex of eager receptors.

Light is one of the best-known attractors, as indicated by the swarms around an electric light globe or reflected light from a sheet. The power of color is shown when an iridescent morpho butterfly swoops down upon a bit of blue paper. The auditory attractant of a cicada is clearly evident to our senses, and the exact tone of the wings of a female mosquito is an attractant to her mate.

More mysterious than any of the foregoing is the impelling force of mass migration, a yielding to an instinct which, at least basically, is inexplicable. At this moment, thousands upon thousands of insects of almost all orders, are pouring southward through a sixty-foot wide pass near Rancho Grande, Venezuela, repelled from their place of birth or attracted to an unknown area by some all-inclusive impulse.

The chief object of this casual and heterogeneous list of attractants is to point out that certain ones are selective, carrying their messages to individual species, while the remainder are more or less general, appealing to a wider range of recipients.

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II. Fedegoso or Wild Heliotrope Association

Early in the occupancy of the station at Simla, we selected the family of moths, Euchromidae, for particular study. Among the considerations which prompted this were intricate instincts of the larvae, day-flying habits of many of the adults and the frequency of apparent mimicry.

During the first season, from December, 1952 to May, 1953, our collecting was restricted to three methods: pursuit, in the field, of free-flying moths; the capture of those which alighted on the laboratory screens in the daytime; and capture of the nocturnal forms that came to an illuminated sheet.

All this was revolutionized the following season by the use of the common weed, *Heliotropium indicum* Linnaeus, which proved to be a remarkably efficient and selective attractant. Our attention was directed to this phenomenon by the notes of G. Hagmann (1938) and A. Miles Moss (1947).

Our cultivated garden heliotrope is derived from the South American wild species, *Heliotropium peruvianum* Linnaeus, and is characterized by the clustered appearance of the blossoms, and their strong, sweet, vanilla-like scent.

The Indian heliotrope, *Heliotropium indicum,* was named by Linnaeus 202 years ago. It has spread from its native home in Asia, and has been acclimated in the New World to such a degree that its present distribution extends from Virginia and Illinois south through Central and South America to Buenos Aires. It has received many common names, the one we have chosen being "fedegoso," although this introduces a semantic misunderstanding. This is a Portuguese word meaning ill-smelling, whereas Hagmann characterizes it as "exquisite." To our senses the dry foliage of the heliotrope gives forth a not-unpleasant, somewhat pungent, musty smell, such as might distinguish a long-used herbarium. Other names, such as eyebright, refer to alleged curative properties. Still other terms, cocks-comb and scorpion plant, relate to the shape of the flower spike.

Shortly after our return to Simla, on December 24, 1953, Research Assistant Rosemary Kenedy located a plant of the fedegoso with the assistance of the Botany Department of the Imperial College of Tropical Agriculture. From then on, assiduous search revealed many scattered clumps of this plant. It grows in waste places, such as old, neglected gardens and fields, usually singly or in small clumps. It is a typical weed, wholly undistinguished, without intensive odor or color. This wild heliotrope is a small plant, from one to four feet in height, with single, curved spikes of small, pale lilac blossoms. These spikes or racemes are often divided longitudinally into thirds; the terminal third with unopened buds, the middle of full-blown flowers, and the basal third of developing seeds. The stems are hairy, the branches coarse, the leaves large, and oval or ovate. The roots are short and thick and have only a comparatively slight hold on the soil.

In our use of the weed, uprooting is the first step. A half dozen plants are pulled up and shaken free of soil. At Simla the roots are tied together with twine and the cluster is suspended upside-down from some low branch or from a stake driven into the ground. A favorite place is along an open trail through the jungle or in an area free of vegetation close to the forest's edge. The leaves shrivel soon after the plant is collected and lose whatever of apparent symmetry or character they may have possessed. During subsequent days of sun and rain the foliage becomes in succession dry and brittle, saturated and sodden.

For the first two or three days little activity is observed around the withered plants. Then one, two, a dozen butterflies and moths appear, coming upwind, and all alight. The desiccated racemes of flowers and seeds seem to exert especial attraction, but the stems, leaves and roots are far from neglected.

The dominating point of interest in fedegoso, as an attractant, is its selective quality. In the course of five months of observation in and around Simla, we detected members of only four families of Lepidoptera coming to the bunches of dead plants. Two of these were butterflies, Danaidae and Ithomiidae, and two were moths, Euchromidae and Arctiidae. Other groups, such as heliconids, nymphalids and pierids, sometimes flew past the dry vegetation, but no individual ever alighted or even hesitated. Added to this is the fact that in most classifications the four selected families are placed at the top of their respective groups, presumably indicating extreme specialization in the scale of lepidopteran phylogeny.

This remarkable, selective, attractant phenomenon was reaffirmed during a few weeks of our experience with fedegoso in Surinam, and in reports from Pará, of Hagmann and Moss.

The selective quality of fedegoso is apparent in other than lepidopteran families. Details of specific selection as shown in Euchromidae will be discussed in future papers. One example will suffice here. Until we began to use this method of collecting we had never come across a specimen of *Sphecosoma trinitatis* Rothschild, a close mimic of a small *Polybia* wasp. The resemblance

is so exact that only close examination reveals the difference between moth and wasp. In the course of five months we took or observed one hundred and forty-seven of these wasp-mimicking moths on fedegoso, and these resolved into three distinct species, two of which had not heretofore been recorded from Trinidad.

Arctiidae was the only other family of moths attracted by fedegoso, and this sparsely, as only fourteen specimens of seven species were taken, three of which were uniques.

As euchromids were the dominant fedegoso group among moths, so ithomiids were, far and away, the more numerous of the butterflies. Fifteen species of Ithomiidae have been recorded from Trinidad. Of these, on March 21, 1954, at 8 A.M., on two adjacent bunches of fedegoso, I observed or collected eight species, totalling a minimum of 257 individuals. The shade-loving, skeleton-winged species *Ithomia drymo pellucida* Weymer and *Hymenitis andromica trifenestra* (Fox) excelled in numbers, comprising three-fourths of the total ithomiids.

We recorded small numbers of two species of Danaidae, the first of which, *Danaus plexippus megalippe* (Hübner), is the tropical representative of our northern Monarch. The striking *Lycorea ceres ceres* (Cramer) was present in numbers and the same individuals often returned day after day, conspicuous in their ithomiid type of pattern and coloring.

There seems little doubt that the first appeal of the attraction of fedegoso is through the olfactory senses of the Lepidoptera, as evinced by the approach upwind, together with the total lack of advertising or directive coloring in the plant.

Soon after the insect alights, or occasionally just before, the tongue unrolls, the tip probing and prodding about as the organ comes into function. Careful examination of the surface tissues of fedegoso fails to reveal any evidence of liquid drops or other source of nourishment. Nevertheless, so potent is some such aliment that it affects the whole behavior of the insects. After a short period of feeding the insect loses its timidity and will often permit itself to be picked up by the wings, examined and replaced, or it may be captured by gently slipping a glass vial over it. When crowds of ithomiids are clustered close together, they will often buffet one another without taking flight.

During this first season nothing was done about chemical or other study of the nutritive substance of fedegoso. While it exerts a noticeable effect on the reduction of the escape reaction, this is in no sense through what might be called intoxication, as in the case of butterflies feeding on fermenting fruit. The insects show an obvious reluctance to leave their repast, but once on the wing, their flight is swift, accurate and typical. They quickly return to their feeding on leaf or raceme.

A quotation from the notes on fedegoso in Pará, Brazil, by A. Miles Moss will present the similarities and the differences of our observations on the same plant. The suspended, dried plants, he says, "constitute a most remarkable attraction for the great majority, though not all, of the species of Syntomidae [Euchromidae], as well as for the closely related Arctiidae; also for many Danaiid butterflies, particularly the Ithomiinae, for wasps of many kinds, for a few beetles, for grasshoppers, for bugs, mosquitoes and flies of all sorts." Aside from Lepidoptera, there is considerable discrepancy between recorded visitors as observed at Pará and at Simla. At the former place in Brazil numerous non-lepidopteran visitors were observed. In our experience, such insects are rare or absent. In the case of mosquitoes, Hagmann indicates that they divide their interest between fedegoso and the observer, who is attacked "unmercifully."

Of the non-lepidopterans we noted only three species of wasps, which occurred rarely, and on plants desiccated for more than two weeks, so old that they had lost their attractiveness for moths and butterflies. Besides this, there were two species of small longicorns which, on four occasions, were found, usually in pairs, wandering about the dry foliage. Now and then we had hints of minor adaptations and inter-relationships beginning to take shape on our fedegoso. Twice we found flower spiders and once an orb-weaver trapping and devouring unwary euchromids. On another occasion a mantid had found the dry vegetation good hunting and was holding a euchromid in the grip of its forelegs, and a ponerine ant was discovered carrying off an ithomiid. The several times that we discovered butterflies sleeping on the same twig from which they had been feeding during the day suggested opportunities for new arthropod relationships.

Heliotropium is a genus of plants of the borage family, Boraginaceae, and the thought occurred to us that botanical consanguinity might carry with it some of this mysterious attraction for insects. Miss Kenedy made a few preliminary experiments with shrivelled twigs and leaves of two species of the genus *Cordia*, namely, *C. alliodora* or Cypre, and *C. cylindrostachya* or Black Sage. These gave no positive results.

Of a third genus of the borage family, *Tournefortia*, we had no available material. Upon our return to New York we received a letter from Dr. P. A. Buxton referring us to notes made by himself, 1926, and by Mr. G. H. E.

Hopkins (1927) on trees of this genus growing on Samoa and other Pacific islands. Dr. Buxton writes that he found that "males of the genus *Euploea* of several species, in several different islands in the South Pacific, occur in numbers on withered twigs of the tree *Tournefortia*. The insect does not feed on that tree and the butterflies do not visit the flowers of that tree. The observations were made repeatedly but one cannot explain them."

This gives hope that more extensive experimentation with members of the borage family may reveal other related plants that share this attractant quality.

III. Tangerine Association

On March 6 and on two successive days I observed a Cacao Caligo, *Caligo eurilochus minor* Kaye, resting on a particular spot on the branch of a tangerine tree, a citrus, *Citrus nobilis* Andre, whose fruit is otherwise known as portugal or mandarin orange. The tree was one of a row in the citrus grove on Water Trail, a few yards to the east of Simla Laboratory. The insect was unusually fearless and permitted close observation. It was busily probing with its tongue in a small area of what looked like the exudate of a spittle insect.

Subsequent observation and consultation with Dr. Egbert Tai of the Government Agricultural Experiment Station tentatively identified the puddle of white foam as probable evidence of the Crotch Disease of tangerines. Of this malady it is said that the cause is not known but a virus is suspected. One of the most conspicuous symptoms is a white froth, which may ferment, and oozes from openings in the bark. From time to time there may be a rehealing. Examined under a hand lens, bubbles are seen to surge up from below, burst, and their place taken by others. Except for these little scattered lesions the disease seemed no detriment to either blossoms, fruit or foliage of the trees under observation.

On the branches of two adjacent tangerine trees there were several small areas of the pale exudation. These seemed to bubble and to overflow at times, and again in temporary drought they dried up. At all times they were sources of intensive attraction to certain insects. As in fedegoso, the attractive agent was strongly and definitely selective.

A. Lepidoptera

In the course of several weeks of intermittent watching I observed fifteen species of butterflies alighting at one or the other of three small areas of bubbling froth, small puddles not more than one-half by one inch. I bored holes through the bark and wood, and daubed sugar and honey on the trunks, but failed to distract the attention of the insects from their chosen ambrosia. Seldom did a butterfly alight on the trees except within tongue's reach of the froth. On the occasions when this did happen, there was instant approach to the attractive substance.

The fifteen butterflies were distributed among three related families, Nymphalidae, Morphidae and Brassolidae, in the proportion, of known Simla species, of 33%, 100%, and 60%. Although few in number of species, this group nevertheless included the largest and, in color and pattern, the most striking of Trinidad's tropical butterflies.

The following is a list of the species of Lepidoptera observed at the tangerine feeding lesions, together with a few casual notes.

The large, Green-checkered Nymphalid, *Victorina steneles steneles* (Linnaeus), joined the tangerine association three times. One marked individual returned repeatedly for a week. When feeding it kept its wings closed, not flattened in the normal position of sunning. Also it confined its visits to the sunniest, warmest parts of the day.

Peridromia arethusa (Cramer), the Blue-spotted Black, visited the trees day after day, singly, or a pair at a time. They alighted in an inverted position, with wings flat against the bark. If at a distance from the froth, they approached by runs or short spurts, with a single flap of the wings at beginning or end. Occasionally a histerid beetle would push beneath the wings, causing a momentary flapping but not distracting the insect from its feeding. Once a *Colobura* alighted *on* the flattened wings, sending the insect into flight, but the Blue-spot returned and in turn drove away its annoyer.

The Red-banded Hindwing, *Biblis hyperia* (Cramer), is common about Simla but a rare visitor to the tangerine trees. Twice it was seen feeding on the froth, like *Peridromia* alighting upside down, with flattened wings.

On April 3, an individual of the Six Orange-spot, *Catonephila numilia* Cramer, came to the bait. This was a new record for Simla and Arima Valley. Two others were seen later.

The Zebra Clicker, *Colobura dirce dirce* (Linnaeus), was the only member of the tangerine group to be found commonly in the general vicinity at all times. During the present period of watching, from two to eight individuals were present at the bubbling areas. They had a regular flight routine, a quick, whirling dash, followed by a swoop to the bark of the nearest tree, alighting inverted, with closed wings. They often progressed by a series of short, quick runs over the branches. Zebra No. 1 had lost a full fourth of wing area, yet flew well.

It was present on the first day, March 6, and on the last, May 18, the same individual was seen feeding while perched on the wing cases of a large, brown, eyed-elater. This butterfly was among the most persistent in pushing aside the beetles and flies which interfered with its feeding. It not only pushed but slapped with sideways flicks of its tongue, to obtain for itself free access to the froth.

A medium-sized leaf-brown butterfly haunted the tangerines for a week before I could capture and identify it. It proved to be *Anaea morvus morvus* (Fabricius) deserving the vernacular name of the Tailed Pygmy Morpho. On alighting its wings snapped together and it became as much of a stemmed, dead leaf as any Kallima. Above, it was conspicuous, the proximal half of the wings iridescent morpho blue, the remainder black with two anterior, small, blue spots. This was the second specimen to be taken at Simla.

At first glance I thought that the family Ithomiidae must be included in the tangerine association, but a butterfly observed on March 14 proved to be another nymphalid—*Protogonius ochraceus* Butler, tailed and of typical ithomiid pattern. Several were observed, one of which crept close alongside a preponid and fed while brushing wings with the larger species.

Historis odium orion (Fabricius) was recorded six times, comprising at least four different individuals. In brief glimpses of the orange and black of upper wings in flight it resembled a brassolid; when alighted it closely approximated *Prepona.*

No day passed without one, two or all three species of preponids being present, feeding upon the frothy matter. These were *Prepona demophon* (Clerk), *Prepona antimache* (Hübner), and *Prepona meander* (Cramer). Owing to their swift flight among the lights and shadows it was impossible to differentiate the species on the wing, but after alighting, the under wing pattern was diagnostic. Especially was this true of *meander,* with the sharply demarcated halves of light and dark brown. All were seen to defend their position against encroachment by other butterflies or by beetles and flies. The tongues of preponids are pale red and seem stout enough to push and buffet aside any interfering insect. These usually wary butterflies were all exceedingly tolerant of approach, almost permitting one to touch them before taking flight.

Two individuals of the Trinidad Morpho, *Morpho peleides insularis* Fruhstorfer, were members of the tangerine association, coming to drink at odd times, and by sheer size and weight taking possession of some of the food areas.

Five Coconut Brassolids, *Brassolis sophorae sophorae* (Linnaeus), were visitors to the tangerines. Individual count was made possibly by the various degrees and positions of wing damage. Two of these insects made return visits throughout five weeks.

Two out of the three species of Trinidad Owl Butterflies or Caligos came to drink at the tangerine supply. These were *Caligo eurilochus minor* Kaye and *Caligo illioneus saltus* Kaye. These were easily identifiable on their alighting, because of their relative size, *minor* being appreciably the smaller. The ocellus in *saltus* is almost twice the size of the other. These great butterflies seldom came into contact with the others because of their crepuscular habits, arriving in early morning and in late evening.

B. Orders Other than Lepidoptera

Less attention was paid to orders other than Lepidoptera. They were few in number, both of species and individuals. All were drinking at the lesions.

1. Coleoptera

Large Green Elater, *Chalcolopidius virens* (Fabricius). Three were seen at feeding troughs on separate occasions. Did not seem to mind being picked up and replaced.

Large Brown Eyed-elater, *Pyrophorus pellucens* Eschscholtz. Two seen and captured.

Large Black Cetonia. One was captured on May 9 and another seen the following day.

Black Histerid Beetle. Feeding almost every day, usually in pairs.

Small Red-headed Histerid. Several every day.

2. Diptera

Stilt Fly, family Micropezidae, genus *Odontoloxozus,* species probably new. These were present in small numbers every day, two to six at each drinking station. They were very active, moving forward, backward and sideways so smoothly that they seemed to flow over the bark. In spite of being constantly flicked aside by the tongues of the butterflies, they persisted and occasionally took their stand *beneath* the bodies of the larger insects.

Hairy, Blue-bodied Fly, Tachinidae. Several seen.

Drosophila. A group of a dozen congregated at one source of nutriment during a week's time. Not seen at the other lesions.

3. Hymenoptera

Trigonid. Two seen, one taken. A large nest of these bees was established a few yards away, yet none, other than these two, was seen at the tangerines.

IV. Summary

Two unrelated plants, under very different conditions, have been found to be characterized by their pronounced selective power of attraction for a few definite groups of Lepidoptera.

The first is fedegoso or wild heliotrope, *Heliotropium indicum* Linnaeus, which exercises a powerful attraction for two families of butterflies, Danaidae and Ithomiidae, and two families of moths, Euchromidae and Arctiidae. These four families happen to be the most specialized in their respective groups. The attraction or lure becomes effective only on the death of the plant and after the consequent shrivelling and desiccation of the foliage. It persists for ten days or two weeks.

The second plant is the tangerine orange tree, *Citrus nobilis* Andre, afflicted with what is probably a virus disease. The lure is the fermented matter exuded from small, bark lesions. In this case the attraction extends to three families of Lepidoptera, Nymphalidae, Morphidae and Brassolidae.

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EXPLANATION OF THE PLATES

Plate I

Fig. 1. Fedegoso (*Heliotropium indicum* Linnaeus) growing wild.

Fig. 2. Terminal inflorescence of fedegoso.

Plate II

Fig. 3. Fedegoso suspended from a branch, with more than 30 butterflies feeding on the seed panicles.

Fig. 4. Ithomiid butterflies attracted to fedegoso.

Plate III

Fig. 5. Ithomiid butterfly, *Ithomia drymo pellucida* Weymer, male, with proboscis starting to uncoil, alighting on fedegoso.

Fig. 6. Day-flying euchromid moths feeding on seed panicle of fedegoso. Above: A wasp mimic, *Pseudosphex melanogen* Dyar, male. Below: *Dinia mena* Hübner, male.

Plate IV

Fig. 7. *Prepona antimache* (Hübner) feeding at tangerine lesion with histerid beetles.

Fig. 8. *Prepona meander* (Cramer) feeding at tangerine lesion with Stilt Flies, Micropezidae.

FIG. 1

FIG. 2

TWO LITTLE-KNOWN SELECTIVE INSECT ATTRACTANTS

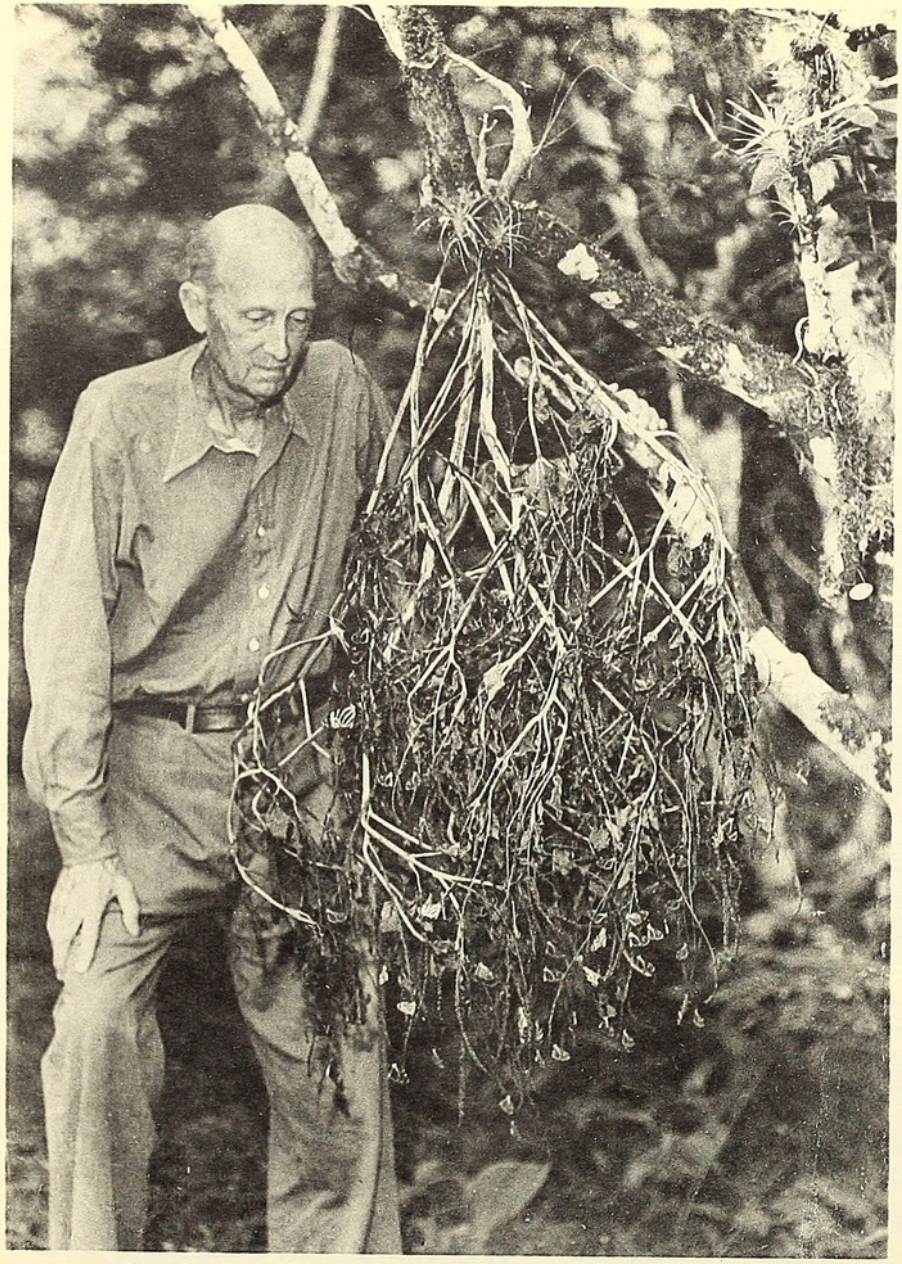

FIG. 3

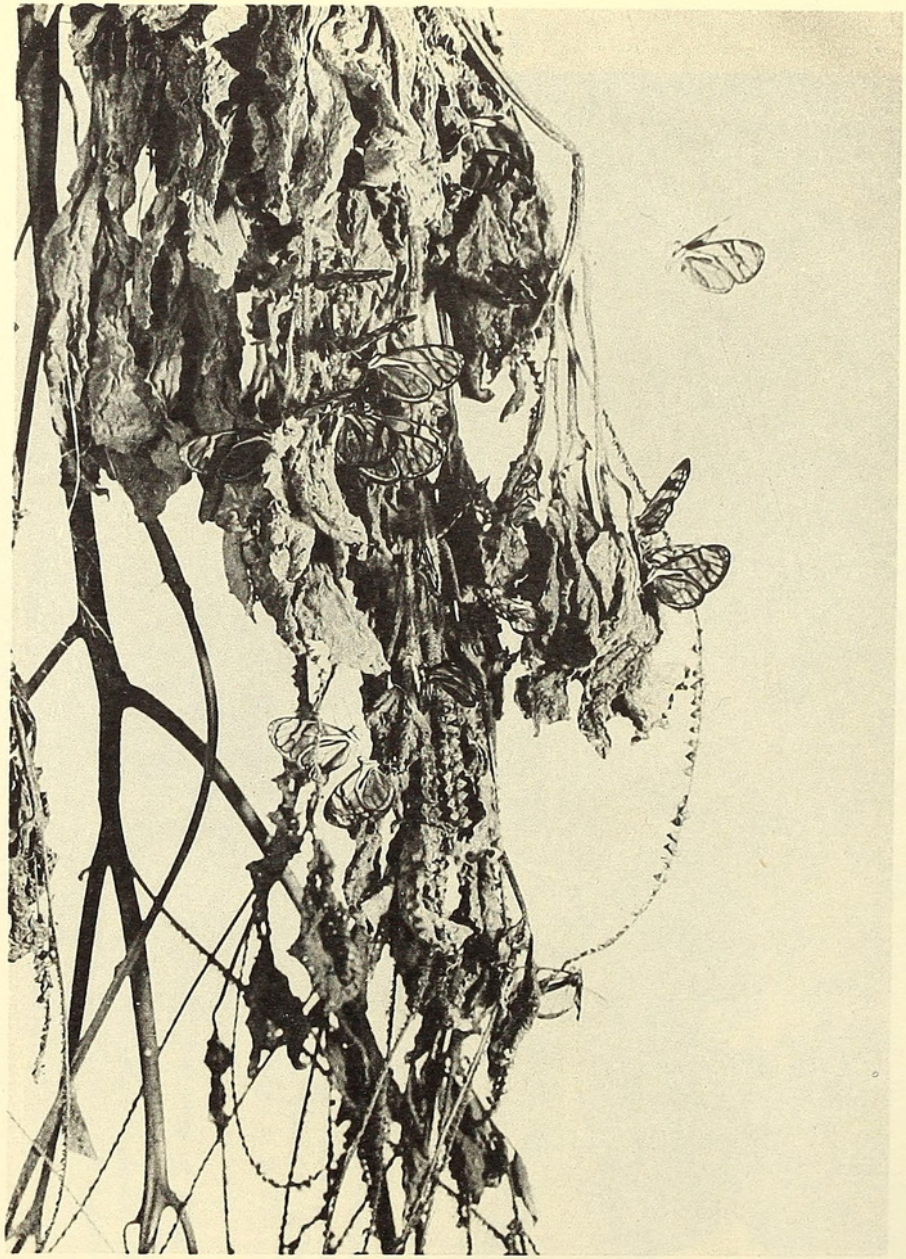

FIG. 4

TWO LITTLE-KNOWN SELECTIVE INSECT ATTRACTANTS

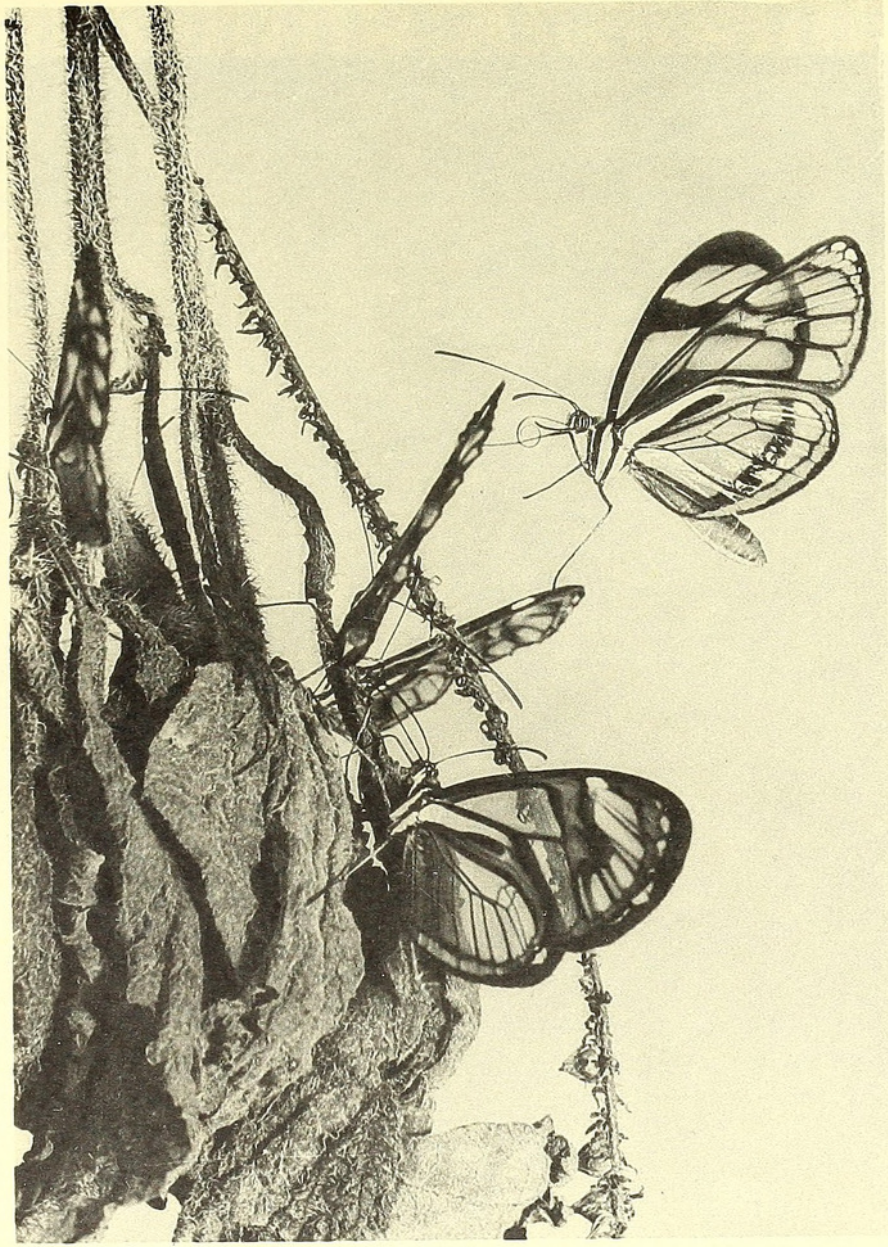

FIG. 5

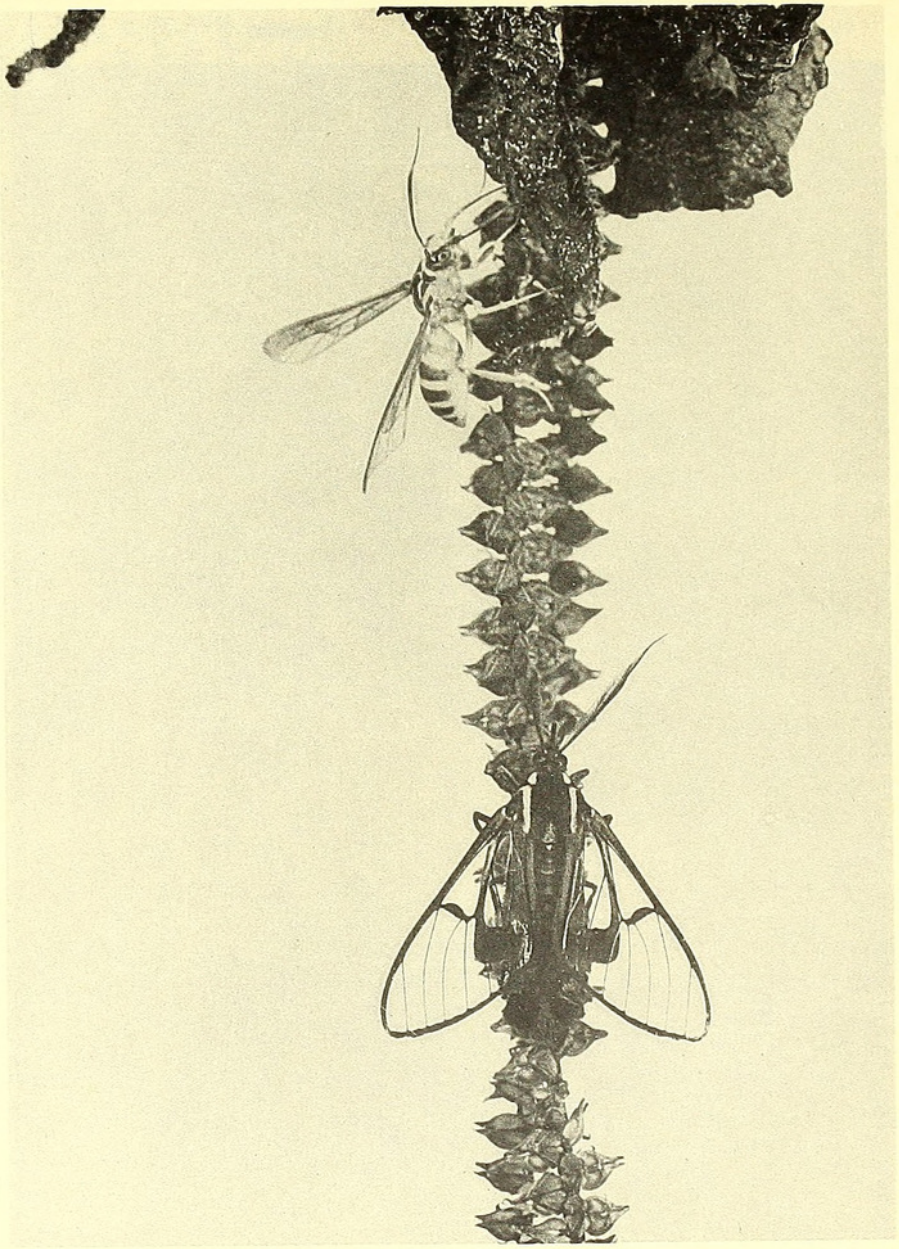

FIG. 6

TWO LITTLE-KNOWN SELECTIVE INSECT ATTRACTANTS

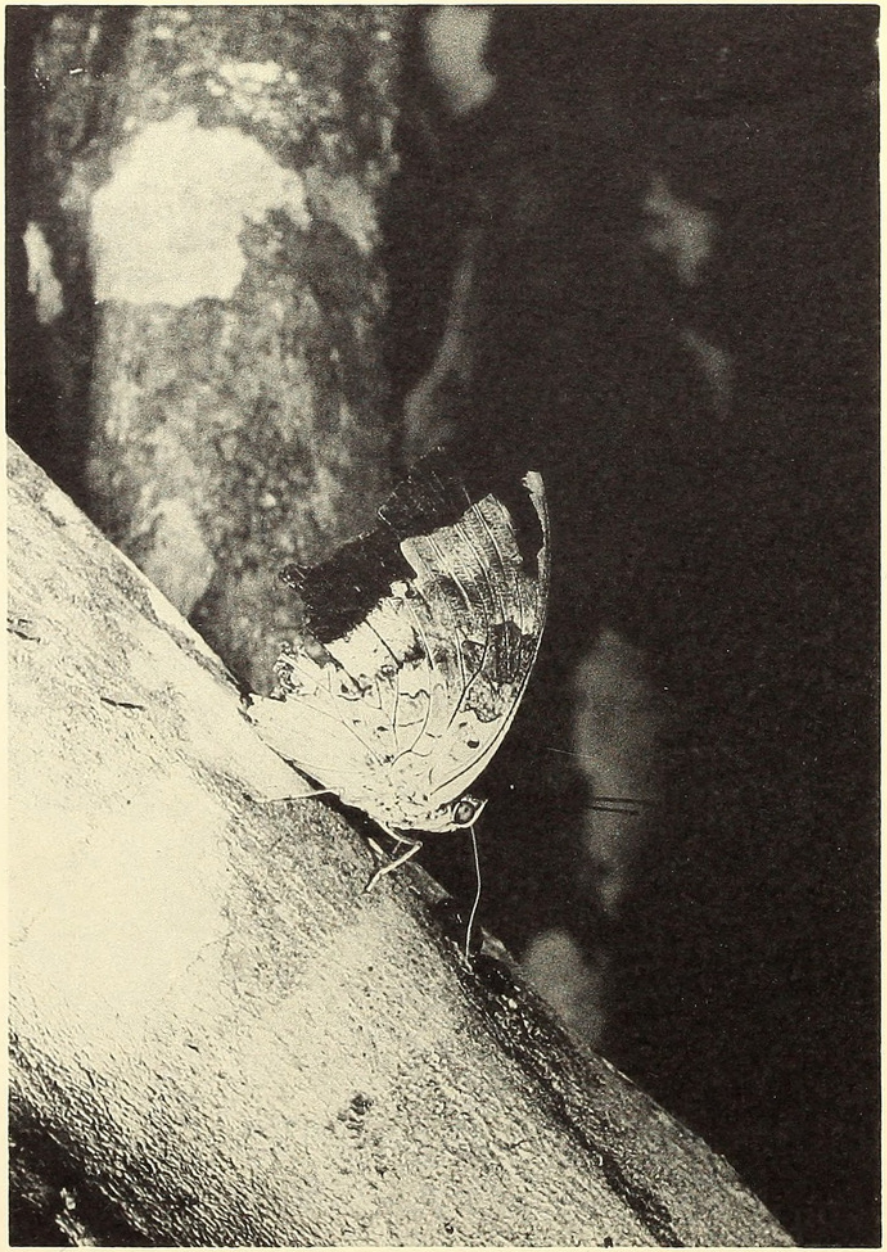

FIG. 7

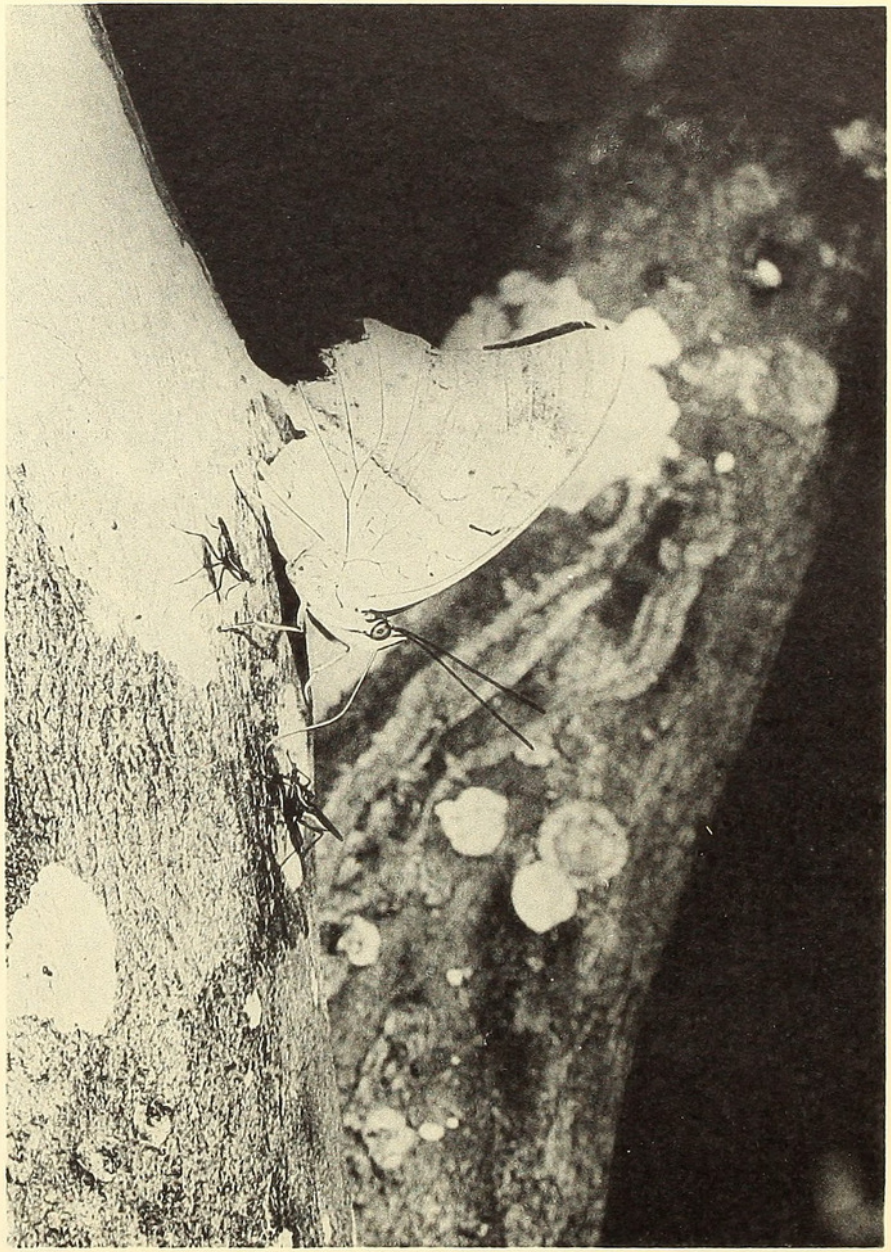

FIG. 8

Beebe, William. 1955. "Two little-known selective insect attractants." *Zoologica : scientific contributions of the New York Zoological Society* 40(2), 27–32. https://doi.org/10.5962/p.203413.

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