



These brilliant scarlet passion-flowers, nearly six inches across, blaze forth in the dim light near the ground in the Central American woodlands. The surrounding foliage does not belong to the flowers, but to plants of other species. The passion-flowers are borne on special basal shoots of vines which climb high into the trees and display their three-lobed leaves in the brighter light.

Scarlet Passion-Flower

By ALEXANDER F. SKUTCH

BEHIND my house in Costa Rica rises a steep hillside, where the horses crop the short grass and pick up the aromatic fruits that fall from the scattered, brown-barked guava trees. On its farther side the narrow ridge falls as steeply into a deep vale, where a cluster of tall tree-ferns has been left standing to adorn the pasture with their spreading crowns of intricately divided fronds. Beyond this moist hollow, tall second-growth woods rise up like a wall beside the open pasture. Along the edge of this woodland, during the bright days of January and February, brilliant spots of scarlet are visible from afar. These are the scarlet passion-flowers, *Passiflora vitifolia*, which bloom only in the dry early months of the year.

It is not easy to enter these tropical woods, along whose exposed edge bushes and interlacing thorny vines form a barrier of vegetation that stubbornly resists the intruder. But here and there the cattle have forced a passageway. Pushing in through one of these narrow gaps, I find myself in a dim, subdued light that contrasts violently with the brilliant sunshine of the neighboring pasture. Here and there the vivid color

of a passion-flower catches my eye amid the tangled undergrowth.

Bright blossoms seek bright sunshine; yet the most brilliant wildflower of the valley is displayed here in the dim light near the ground. I look about me for the foliage of the woody vine that produces these superb blossoms. A few three-lobed leaves, like those of the grape, grow from the slender branches that bear the flowers. But most of these leaves are small, and there seems to be far too little leafage to support such long racemes of big blossoms. Following the rope-like ascending vines with my eyes, I catch glimpses of more of the three-lobed leaves far up among the branches of the trees. When I return to the clearing and scrutinize the roof of the woodland from the outside, it becomes clear that the main mass of the vine's foliage is spread over the upper boughs of the trees, in the sunshine. But here are none of the scarlet blossoms that seem to light the deep woodland.

Why this separation of the foliage and the flowers of the same plant? The situation is not unique among tropical vegetation, where a number of trees and vines

produce flowers and fruit low on the main trunk (a condition that the botanist calls "cauliflory") or on special, often leafless, basal branches; yet it is sufficiently rare to call for explanation. While I stand pondering this puzzle, a big, brown hummingbird darts up through the undergrowth and poises beside one of the red blossoms, into which it pushes its long, strongly curved, dark bill. As it hovers on wings vibrating too rapidly to be seen, it wags its long, slender, white-tipped tail slowly up and down. One of the larger of the Central American hummingbirds, the buff-browed hermit, *Phoebastria superciliosus*, dwells within the primary forest and the heavier secondary woodland, where it spends most of its life near the ground. Sometimes I have found its nest, a soft pocket of down and fibers attached beneath the tip of a frond of a small palm, usually of a spiny kind. The nest tapers downward to a point that matches the shape of the leaf-tip, to which it is attached by an abundance of cobweb. In this swinging cradle, sheltered from rain and from prying eyes by the broad surface of the palm frond, the two tiny white eggs are hatched by the solitary mother, and the young hummers rest until, at the age of three weeks or more, they can fly. During the breeding season the male hermits, who take no interest in family affairs, perch on twigs near the ground, tirelessly repeating a squeaky note while they wag their long tails rhythmically up and down.

As I continued day after day to watch the passion-flowers, I became convinced that, in this locality at least, the buff-browed hermits are their principal pollinator. It seems probable that the low position of the blossoms is an adaptation to secure the services of this and related hummingbirds as pollinators. The scarlet passion-flower ranges, through the humid lowlands and foothills, from Nicaragua to Peru, hence does not extend beyond the area of distribution of hummingbirds of the genus *Phoebastria*, most if not all of which prefer the undergrowth of the woodland to its upper stories. Rarely, in this vicinity, the scarlet passion-flowers are visited by a green hermit, *Phoebastria guy*, in size and form much like its buff-browed relation, but bronze-green rather than brown in plumage. But the green hermit is at home higher in the mountains, and rare here at 2500 feet, except when driven downward by long-continued, cold rainstorms.

Once a Delattre's saber-wing, *Campylopterus hemileucurus*, a hummingbird as big as the buff-browed

hermit and with a bill nearly as long but more strongly curved, took possession of a group of passion-flowers for a week or more. During this period the buff-browed hermit, who had been a regular attendant, could make only furtive visits, for if discovered it was chased away by the heavier saber-wing. But the saber-wing is not often seen in this locality.

Of the twenty kinds of hummingbirds on this farm, I saw only one other making repeated visits to the passion-flowers. This was Longuemare's hermit, *Phoe-*

thornis longuemareus, a smaller replica of the buff-browed hermit abundant in second-growth thickets. But with its shorter bill, less than an inch in length, this little hermit can not reach the nectar in the heart of the passion-flower. It contents itself with visiting the nectaries on the floral bracts, where it either sips the sugary secretions or picks up the small insects that are attracted by them. Its mode of visiting the flowers makes it quite certain that it does not transfer pollen from blossom to blossom. Only the three hummingbirds with bills more than an inch and a quarter in length can reach the nectar in the blossom itself and serve as pollinators.

Although it grows in the primary forest, the passion-flower is in this locality most abundant in tall, rich, second-growth woodland. Rarely, one of the vivid blossoms is displayed as high as

forty or fifty feet above the ground, but the great majority are much lower. Perhaps most are not above a man's reach, and some even lie upon the ground. They are borne, not on the main stems of the vine, but upon slender, whip-like lateral shoots, an eighth of an inch or less in diameter and up to ten feet in length. These floral branches sprawl over the ground, rocks, or surrounding low vegetation, or, if arising higher on the main stem, may hang limply in the air. Those that find some low support become the longest. They seem never to branch unless their growing tip has been injured. If in a position where they receive a fair amount of light, they bear well developed leaves of the usual trilobate form; but in the deepest shade of the underwood the leaves are much reduced in size. At times they are tiny rudiments, which soon die.

Each of the leaves of the floral branches, if not too reduced in size, bears at the base of its furry stalk a pair, or sometimes three or four, small, reddish nectary glands, cup-shaped and opening downward. In the axil of each leaf there arise, side by side, a flower bud and a long, unbranched tendril, which is often rudi-

Blue Ridge Christmas

By ULRICH TROUBETZKOY

If Mary comes to Laurel Branch,
The elder flowers sweet and blanch
Will winter-blossom, herbs will spring,
And the hushed birds will soar and sing.

If Mary comes a visitor,
She will not find a bolted door;
Hill folk can always find her room
And weave for Jesus at the loom.

Tell Mary, Laurel Branch is wild,
A fitting place to hide the Child
From Herod's anger. Bear and deer
Would keep the secret of Him here.

Hill people keep a truckle bed
With a goose pillow for His head;
Tell Mary, we look for the Star
Above the mountains where we are.

mentary. Above these is an accessory bud that normally fails to develop, but may produce a branch of the floral shoot if the tip of the principal shoot is destroyed. The flower bud is surrounded by an involucre of three pale bracts, each broadly lanceolate in outline, and equipped with a number of nectary glands along its fringed margin. Thus, apart from the floral nectaries, the flowering shoot is provided with numerous extra-floral nectaries, whose secretions attract many ants, other insects, and the small hermit hummingbirds.

The mature flower buds begin to open during the later part of the night. I have found the sepals and petals beginning to separate at three o'clock in the morning. When, soon after five o'clock, the first glimmer of dawn brightens the eastern sky, the big blossoms are half open, or sometimes more; and the anthers have already split to release their pollen. An hour or less later they are fully expanded. Often the sepals and petals continue to turn back until they are strongly reflexed and surround the pedicel or floral stem. The five sepals and five petals are all much alike in size, shape, and intense red color; but the sepals are somewhat longer, fleshier, and broader. They are strengthened on the outer side by a keel, which the petals lack. When fully expanded the great blossom measures from five and one-half to six inches in diameter. There are rarely more than two or three open flowers on any one plant, and usually only a single one on even the longest floral shoot, for they open in succession from the base toward the tip.

The flowers stay open and are visited by the hummingbirds throughout the day. A few have perceptibly begun to close before sunset, but others are wide open when darkness falls. They close gradually during the night and are well folded up by the following dawn. Each flower opens for a single day. After closing, the perianth gradually withers but persists about the stipe of the swelling fruit. Even if pollination is prevented so that seeds are not set, the blossom folds up at the end of its single day of glory and fails to open again. But there is a constant succession of flowers until, in March, the increasing dryness puts an end to the blossoming of the passion-flowers. The last blossoms of the season may be pale pink in color and only half the normal size.

Of the complex structure of the passion-flower, it will be necessary to mention here only a few salient features of great importance in relation to its mode of pollination. The ovary is not, as in the great majority of flowers, situated between or even below the bases of the petals, but is borne at the summit of a long, slender stalk that emerges from the center of the blossom and is clearly shown in the photograph. From the summit of this exposed ovary diverge three styles, each of which terminates in an expanded stigma turned so that the surface receptive of pollen faces downward. The five stamens form a ring about the base of the ovary, and are so placed that the five big anthers, each loosely attached by its middle, hang between the stigmas, also

facing downward into the flower.

In the center of each flower, surrounding the long stalk, which holds the ovary aloft, is a triple crown of long, slender fringes or filaments. Each filament is red, or red and white, or sometimes almost wholly white. This "crown of thorns," and other less obvious resemblances of the parts of the flower to the instruments of Christ's Passion, or suffering and crucifixion, led early missionaries to America to give the name "passion-flower" to plants of this genus. Below this crown, the central stalk that supports the ovary is closely surrounded by a collar or sleeve of thick tissue, fringed at its upper edge and its lower edge turned upward like a cuff. This complex structure investing the central stalk guards the nectar richly secreted by glands at the very bottom the tubular basal portion of the perianth. Its functions seem to be, first, to keep out insects and short-billed hummingbirds that might steal the nectar without paying for it by transferring the pollen. Second, to control the position of the preferred visitors, such as the big hermit hummingbirds. To reach the nectar these are forced by the stout collar to hold their bill nearly parallel to the central stalk. Thus no matter whether the flower face upward or sideways, the hummingbird while sucking nectar must place its head in such a position that its crown will brush against at least some of the five anthers and three stigmas that form a ring above it. The long-billed hummingbirds that I saw visiting the flowers had the tops of their dark heads richly dusted with the pale pollen. They were working for the bountiful plant even if they did not know it.

The edible fruits of passion-flowers are called "grandalas" in tropical America, "maypops" in southern United States. In most of them, the edible portion consists of the soft, gelatinous envelope that surrounds each of the numerous small, dark seeds that fill the cavity of the usually dry, tough fruit — technically a berry. The fruits of the several species vary greatly in size and edibility; some are scarcely bigger than grapes, others almost a foot in length; some have a distinctly unpleasant odor; others are sweet and aromatic. The ripe fruit of the scarlet passion-flower, of about the size of a large hen's egg and much the same shape, is prettily mottled with green and white.

Once in late April, in the tall second-growth woods where earlier in the year the scarlet blossoms had been conspicuous, I watched a squirrel feasting on one of these fruits. The furry little animal sat on a thick bush-rope lying along the ground at the base of a tree trunk. It held its thick, auburn tail above its brown back; and the fruit lay on the ground before it. It had opened one side to expose the gelatinous mass that filled the cavity. Taking a double handful between its forepaws, it ate eagerly, repeating this over and over. From time to time it bit away more of the mottled rind to expose the seeds, but this dry tissue was cast aside, only the interior mass being eaten. The seeds were swallowed along with the mucilaginous mass in which each was separately imbedded, just (Continued on page 550)

If so, why not plan to enter the eighth Chicago International Exhibition of Nature Photography, sponsored by the Chicago Nature Club and the Chicago Natural History Museum? Deadline for entries is January 17, and entry blanks may be obtained from H. J. Johnson, 2134 W. Concord Place, Chicago 47, Illinois.

There are two divisions, one for prints and the other for transparencies, and each division has three classifications — animal life, plant life, and general. There is an entry fee of \$1 for each division. Silver medals and ribbons will be awarded to winners in the various print and slide classifications, and accepted contributors will be eligible for listing in *Who's Who in Nature Photography*.

Do not forget the deadline — January 17. Write soon for your entry blanks. Please mention "Camera Trails" when you do.

BIRTH OF A LAKE

(Continued from page 516)

The forces that brought about the wholesale destruction of the small rodent population, drove the ground birds and small insect-eaters out of the mesquite covered valleys, and drastically changed the status of several larger mammals, created a wonderful habitat for many kinds of water birds. In the long run, it may prove a blessing to those species of animals so hard hit in the early stages of the rise of the lake. Given time, it seems certain that new plant jungles will develop, furnishing homes to replace those destroyed by the rising waters. Whether these will come fast enough to save the remaining animals existing in the sparsely vegetated washes is problematical. Certainly those that survive the present ordeal will be worthy representatives of their race!

SCARLET PASSION- FLOWER

(Continued from page 525)

as a man eats a granadilla. Probably the seeds themselves would pass undigested through the squirrel's stomach and bowels, thereby disseminating the vine. His forepaws and chin dripping with the sticky pulp, the little beast reminded me of a boy blissfully immersed in a juicy mango, forgetful of the cleanliness of his face and clothes. He continued at his feast for many minutes, until he had quite consumed the contents of the fruit — a big meal, I thought, for so small a stomach. His feast over, he carefully wiped his dripping chin by rubbing it against the rough bark of the great vine on which he had been sitting, then scrambled up the long, slender trunk, and hopped away through the tree-tops.

The somewhat unpleasant odor of the rind had in the past deterred me from eating the fruit of the scarlet passion-flower. But the squirrel had so obviously enjoyed it that I decided to sample it for myself. I found that it had a pleasant acid-sweet flavor, but was not quite so agreeable as the common cultivated granadilla.

STRANGE RELATIONS OF BIRDS AND INSECTS

(Continued from page 528)

of protection."

As a striking sidelight, he adds that most of the African birds in question appear to use protective alternatives — either associating with man or building over water; normally building over water but occasionally associating with wasps; and either building alongside insects or adopting the nest of another bird whose architecture is more protective.

Sometimes, it appears, a bird may improve on the use of an alternative by adopting two protective devices at the one time. In North Australia, for example, the large-billed warbler is so addicted to building over water, and has so strong a fancy for material resembling debris, that it is commonly known as the "flood-bird;" and yet it also takes the precaution, quite frequently, of placing its nest close to a colony of wasps.

Similarly, an Australian naturalist wandering in the far northwest found several nests of the buff-breasted warbler overhanging water, and two of them were built with the opening only about twelve inches from large nesting colonies of wasps. "Close examination," the observer wrote, "convinced me that such sites were chosen, after sound reasoning, as a protection against intruders."

Possibly, too, we should regard as a double protective device the practice of the black-throated warbler of not only suspending its nest from a thorny lawyer-vine, but selecting a vine that already carries a wasps' nest.

Is there, one wonders, some significance in the fact that most birds that adopt wasps are species that favor thorny bushes or prickly vines for nesting purposes? Maybe there is. At all events, many records from both South American and Central Africa refer to bird-wasp associations in thorny shrubs — which appear to be especially abundant in Africa — and as the same point obtains to some extent in Australia, it seems that in this matter, as in certain other aspects of the general problem, we get beyond the bounds of coincidence.

Numerous examples of bird-wasp and bird-ant associations were given Mr. Moreau by the late Dr. J. G. Myers, for several years ecological adviser to the Government of the Sudan, and most of