

THE RÔLE OF SUN-BIRDS AND FLOWER- PECKERS IN THE PROPAGATION AND DISTRIBUTION OF THE TREE-PARASITE, *LORANTHUS LONGIFLORUS*, IN THE KONKAN (W. INDIA)*

EVEN the most casual observer of Nature cannot but notice the ubiquitous clumps of the tree-parasite (*Loranthus*) with yellowish-green, rather long, oval-shaped leaves which infest the trees in such profusion in Western India and elsewhere throughout the country. Once it has secured root-hold, the parasite spreads from branch to branch with astounding rapidity, and unless removed in time it is not long ere the host is sucked dry and smothered to death. I have had special opportunities for studying the subject of the rôle of birds in the propagation of the species *L. longiflorus* Dest. during the past year. My observations have brought me to the conclusion that the life-history of the parasite is so inextricably linked up with the existence of Sun-birds and Flower-peckers that it would soon die out altogether without the intervention of the birds. Indeed it seems to me that the only effective way of eradicating the parasite lies in the extermination of the Sun-bird, a vandalism, it is to be hoped however, no one will seriously take into his head to practise. "Man cannot live by bread alone", and the Sun-bird is surely one of those et ceteras that help to supplement bread for the sustenance of man. This symbiosis has brought about the most remarkable specialization in the flowers of *L. longiflorus*, which is now without doubt one of our most highly developed "Bird-flowers" in India. And what is true of *Loranthus longiflorus* is likewise true of many other Indian species as well.

Hosts of the Loranthus.—In Western India, *L. longiflorus* is a serious menace to the mango, and in the mango-growing districts of Ratnagiri and North Konkan the damage it causes must run to thousands of rupees annually. In smaller numbers I have also found it affecting the following trees: *Zizyphus* sp., *Bombax malabaricum*, *Psidium guava*, *Thespesia populnea*, *Grewia* sp., *Ficus bengalensis*, and *Casuarina equisetifolia*, while at Roha, in the Kolaba district I noticed it parasitising on the teak trees (*Tectona grandis*) in the reserved forests. Fischer records *L. longiflorus* from hosts of no less than 104 different species. If those of its varieties are added, the total number of specific hosts given by him is 153.

Flowering Season and Structure of Flowers.—*Loranthus longiflorus* flowers in every month of the year, but the period from mid-November to about the middle of January seems to be that of most abundant inflorescence. Every clump of *Loranthus* is one mass of blossoms at this season. The flowers are white with a faint tinge of cream or sometimes pink. They are about 4 cm. in length, thin, tubular and slightly curved. Their shape and size form, in the upper part, a perfectly fitting sheath for the bill of the Sun-bird. The lower portion of the flowers, where the tube narrows down contains the nectar, one to two drops of a colourless, watery, sweet liquid. The stamens, five in number, rise from the petals and are overtopped by the style which is green and terminates in a tiny swollen knob—the stigma—

* By Salim A. Ali in *The Journal of the Bombay Natural History Society*, Vol. XXXV, No. 1, (1931).

about the size of a pin's head. The anthers are so arranged that when the bill of a Sun-bird is inserted into the flower, they cannot but come into direct contact with the bird's forehead. The five stamens separate on the intrusion of the bill and the anthers lie flat against the feathers, encircling the forehead. The pollen—a golden yellow dust—readily comes off to the touch and adheres to the feathers. The style, extending beyond the stamens, is naturally the first to come into contact with the forehead feathers, and if the Sun-bird has been visiting other flowers previously, the pollen is brushed on to the mature stigma which is thus fertilized. The flowers of *L. longiflorus* belong to the ornithophilous type named by E. Werth "Explosionsblumen" or explosive flowers. How perfectly their mechanism is adapted for pollination exclusively by Sun-birds and Flower-peckers is seen from the fact that the buds will remain closed unless and until the necessary extraneous pressure is exerted to fling them open. The Sun-bird hops from one bunch of blossoms to another, gently squeezing the tops of the mature buds in his mandibles. The pressure causes the bud to spring open or "explode" exposing the essential organs. The bird immediately thrusts its bill into the flower, sucks up the honey by means of its specially adapted, extensile, tubular tongue and passes on to a second bud. The extent of his services in fertilizing the flowers is immense. I have frequently observed one probing into 8 or 10 flowers in less than a minute, and when it is remembered that the bird spends the greater portion of the day in flitting incessantly from clump to clump in the self-same quest, some estimate can be formed of its importance to the *Loranthus*. Doubts have been entertained in regard to the object of bird's visits to flowers being solely for the sake of the nectar, and even to-day some ornithologists are inclined to assume that the search of insects is the primary cause. In the case of the *Loranthus* there can be no such uncertainty as to the peculiar structure of the flowers precludes the possibility of the presence of insect prey within the tubes until the buds have first been visited and thrown open by Sun-birds or Flower-peckers. Besides, considering the high nutritive value of sugar, there seems no reason for doubting that some birds may, in a state of nature, exist exclusively on a diet of nectar. Sun-birds have been kept healthy in captivity for weeks together purely on a syrup of sugar and water and it is difficult to conceive that the "short cuts" by birds to the honey in the flowers of *Sesbania grandiflora* as described by Tiwary and of the many other species noted in Java by Porsch can be for any but this purpose. Birds may—and indeed often do—take in addition to the nectar, small insects if present on the flowers, but there can be no doubt that their visits to "bird-flowers" are mainly in quest of the nectar. The numerous stomach examinations made by myself in the course of this enquiry, chiefly in the season of profusest flowering, on *Leptocoma lotenia*, *L. asiatica* and *L. zeylonica* confirm this.

Pollinating Agents.—In Western India (Konkan) the birds chiefly responsible for fertilizing *Loranthus* flowers are the Sun-birds, three of the commonest species being *Leptocoma lotenia*, *L. asiatica* and *L. zeylonica*, while occasionally Tickell's Flower-pecker (*Dicaeum e. erythrorhynchum*) who visits the clumps principally to feed on the ripening berries, will also lend a hand. I have shot specimens of the last named from flower clusters with pollen adhering to their foreheads. Their stomachs contained much nectar which also dripped freely from the bill when the birds were held up by their legs.

To satisfy myself that the flowers were really incapable of developing without the interference of the bird visitors, I covered a bunch of 21 buds with 12 x 12 mesh wire gauge on 5th December. By the 19th all the buds

had withered and fallen off without a single one setting seed, though at one stage in the interval they were so mature that the red on the dorsal side of the anthers was partly visible through the slits near the top between the unopened, spring-like petals. Later the experiment was repeated on a larger bunch with the same result which shows that the agency of flower-birds is indispensable for fertilization in this species. Evans who tried similar experiments on two African species, *Loranthus kraussi* and *L. dregei* also came to the same conclusion.

Dispersal and Propagation.—The berries which are oval in shape about 10-12 mm. × 4-5 mm., with a minute concave cup at the apex, take about a fortnight to reach maturity, i.e., the stage when they become an attraction to the Flower-peckers. If allowed to ripen, they assume a beautiful rosy-red colour in about 20 days. It is not usual, however, to find fully ripe berries on the clumps as they are rarely allowed to remain long enough by the birds, and except when in the greatest profusion (in late January or February, as a result of the heavy winter flush) they are seldom met with in this condition. Usually by the time they have acquired a slightly yellowish tinge and even before—as soon as the outer pulp shows signs of softening—they are taken by the Flower-pecker. In every bunch of berries there are several with marks of the birds' beak upon them which have been tested and found unripe. The two common Flower-peckers in Western India which give the berries practically whole-time attention are: *Dicæum e. erythrorhynchum* and *Piprisoma a. agile*.

Tickell's Flower-pecker (*Dicæum e. erythrorhynchum*) in my opinion is undoubtedly the most important agent in the dispersal and propagation of the *Loranthus* parasite. I have studied their feeding habits and also examined the stomach contents of a great many specimens, shot in every month of the year, and find that while *Loranthus* berries are eaten whenever available, during the season when they are most plentiful they comprise practically the exclusive diet of this species. In addition to these, the other principal items of its food consist of the round, white berries of *Phyllanthus reticulatus*, an indigenous shrub, the berries of that pernicious imported weed *Lantana camara* which has now overrun and devastated thousands of square miles in India, and those of the "Mistletoe" *Viscum articulatum* another tree-parasite common in these parts on a species of wild *Grewia* and on the Ber (*Zizyphus*). Occasionally small spiders are also taken.

On the whole, its food and feeding habits constitute a serious indictment against the Flower-pecker. *Lantana Loranthus*, and *Viscum* are all highly injurious to forestry and arboriculture. All three (except the first whose berries are eaten and scattered by innumerable other birds as well) owe their propagation and existence more or less exclusively to this Flower-pecker and the next species. It has also been frequently accused of damaging ripe mangoes, a charge which my own observations have been unable to confirm. The Flower-pecker seems to have regular beats or feeding territories within which the individuals flit from one *Loranthus* clump to another at all hours of the day. While on a clump, the bird hops restlessly from bunch to bunch uttering an almost incessant chick, chick, chick which is occasionally varied by a series of twittering notes which might be termed its song. Each berry is first tested between the mandibles; if ripe it is plucked and swallowed, broad-end (i.e., where the stalk attaches) first. After it has bolted down three or four berries, one after another the bird retires to the extremity of some bare branch at the top of the host or on an adjoining tree and sits quiet for a few moments with the feathers partly puffed out. It is during this interval that the mischief is done, for hardly has the bird been there a couple of minutes than you see him becoming uneasy, and presently one of the viscous seeds is excreted. I have often watched this process

carefully through glasses. It appears to involve some effort on the part of the bird, which considering the size of the seed is by no means surprising. The passage of the seed through the intestinal canal and its exit through the anus is no doubt greatly facilitated by the extremely viscous substance in which it is invested. This is clearly evident when a slight pressure is exerted on the abdomen of a freshly killed specimen which very often causes a *Loranthus* seed to slip out of the vent. The seed is invariably extruded broad-end first—therefore, in the identical position in which it entered the food canal—and by a final jerky, and dipping motion of the posterior part of the body, during which the bird often pivots round from its normal crosswise position on the branch to one nearly along it, it is passed out. The extruded seed promptly adheres to the perch, slightly to one side of it.

The discarded seed measure on an average 10×4 mm. They are copiously covered with viscous matter and in addition have attached at the pointed end a sessile, thread-like, extremely viscid process about 22-25 mm. long. There is also a similar process on the broad-end which is much shorter, measuring about 10 mm. These processes resolve themselves into small sticky masses as soon as the seed comes in contact with a branch, helping it to secure its position.

The largest number of seeds taken by me from a single *Dicæum* is four. One of these was on the point of extrusion and partly out of the vent when the bird was shot. The other three were found in the intestine one behind the other, all with their broad-ends in the direction of the vent. In birds the process of digestion is extremely rapid, but in the case of this Flower-pecker it seems to be exceptionally so. The seed probably does not occupy more than 3 or 4 minutes (perhaps even less) after the berry has been swallowed to pass out again. Time and again I have been able to watch the complete process from the swallowing of the berry to the extrusion of the seed, and as the inside of the Flower-pecker can obviously hold only a limited number of berries at a time—presumably not more than 4 or 5—my estimate cannot be far out. Immediately it has got rid of the unnecessary ballast, the bird flies off to some other clump uttering its lively chick, chick, chick. The normal method of feeding with *Dicæum* is to swallow the berries entire. Thus he is responsible not only for conveying the seeds to other branches of the same tree, but also for spreading them further afield to other trees in the neighbourhood. Occasionally I have also seen him pinch and revolve a berry in his finely serrated mandibles, stripping off the fleshy part and wiping the seed on to a near by twig. This habit, however, is more common with the next species.

The thick-billed Flower-pecker *Piprisoma agile agile* is also responsible for much mischief in the propagation of the *Loranthus* parasite, though the damage it does is no doubt considerably less. Examination of stomach contents and a study of its feeding habits show that this species does not swallow the berries entire, except perhaps in very exceptional cases. The bird is in particular evidence on the *Loranthus* clumps between January and March when the berries are in greatest abundance. Like *Dicæum*, it flits about singly from one clump to another also appearing to have well-defined feeding circuits. Its voice and notes are similar to those of the other species only perhaps somewhat shriller and more metallic; but with a little practice the two can easily be distinguished from one another. The bird twists its little tail from side to side as it searches amongst the clumps. The berry is plucked and invariably revolved between the mandibles which being thicker and stouter, appear better adapted to this method of eating. The flesh is soon detached and the seed wiped on to a neighbouring twig by a sweeping side-to-side motion of the head. Occasionally when disturbed at its meal

the bird will fly off with a berry in its bill and this is the only way in which *Piprisoma* may spread the parasite to neighbouring trees. On a *Loranthus* clump on a Guava tree near my bungalow which I had under continuous observation, I found that while the berries were present, *Piprisoma* visited the cluster on an average about six times a day. Three or four berries were plucked on each of these visits, whose seeds were wiped on to the adjoining branches, with the result that within a short time there were hardly a couple of inches in a radius of about three feet of the clump free from the adhering seeds. It is on account of this feeding habit of *Piprisoma* that when lopping off branches affected by the *Loranthus* parasite care must be taken that all the adjacent members are likewise removed as these are sure to harbour some of the seeds.

In addition to *Loranthus* berries, the food of the thick-billed Flower-pecker consists of a great variety of berries and fruits. *Lantana* is a favourite and here again the process of eating is the same as with *Loranthus*, the entire berries being rarely swallowed. It is therefore not responsible for scattering *Lantana* seeds far afield to the extent *Dicaeum* is. Other contents of the stomachs I have examined were pulp of the Jamun fruit (*Eugenia jambolana*) and Peepal figs (*Ficus religiosa*) and also small spiders.

When one considers that these two species, which are by no means uncommon in these parts, are ceaselessly engaged throughout the day and month after month on their task of seed dissemination, one can form a fair idea of their power for evil to humanity and of their vital services to the plants on which they are in turn dependent.