

The association of invading White-winged Crossbills with a southern tree.—The quest for food by invading White-winged Crossbills (*Loxia leucoptera*) leads an occasional band into areas where deciduous woods predominate and conifers are few. Growing evidence indicates that a deciduous tree, the sweetgum (*Liquidambar styraciflua*), may be of importance to the survival of such migrants. In Kentucky during the winters of 1937–38 and 1954–55 (see Mengel, *Birds of Kentucky*, A.O.U. Monograph No. 3:476, 1965), White-winged Crossbills foraged in this species, extracting seeds from the hanging fruits; and the same was true of some birds during the winter of 1965–66 both in West Virginia (Maurice Brooks, pers. comm.) and, as I observed, in southern Illinois.

In structure a sweetgum fruit is exquisitely peculiar, and for this reason a description of its characteristics seems required before considering the implications of the sweetgum-crossbill association.

Lacking scales, the fruit is not in the least conelike except in being pendulent. It hangs, a hard walnut-sized ball, from a 3–4 inch-long stem. Green in the growing season, the ball is actually composed of many small fruits, each bearing two spines which form a single beaklike chamber. The whole ball turns brown with autumn, the spines typically spreading apart to release a pair of winged seeds. However, a small proportion of the spines of some fruits fail to separate; a seed supply consequently remains locked inside certain chambers while the ball remains drooping among naked branches during winter. Interestingly, a near relative of *Loxia*, the American Goldfinch (*Spinus tristis*), alone takes full annual advantage of this benefaction, perhaps because no other member of the regular winter avifauna combines the use of a strong finch bill with the art of clinging up-side-down while adjusting the feet. These attributes appear essential, owing to the toughness and rigidity of the spiny locking device, the length of the stem and the fragility of the brittle connection which in winter secures the stem to its branch. A direct attack on the seed chambers by a bird perching on a fruit—a common practice in fall of both goldfinches and juncos (*Junco hyemalis*)—would tend to sunder the stem connection, plunging the fruit to the ground. Goldfinches reach the seeds by employing various clever techniques; in one the bird first hangs from a twig near a fruit; then uses one foot as a sliding vise which clenches the stem between its base and its branch, drawing the fruit to the bill tips. This method is the one, precisely, which I saw White-winged Crossbills employ in southern Illinois.

The repeated observation of feeding in sweetgums by *L. leucoptera* presents a record which suggests that sweetgum distribution may influence the local winter distribution of the invaders. But two further factors appear to lend a still more special point to this history: first, the northern distribution of the bird as compared to the southern distribution of the tree; and second, the lengthy time intervals between invasion winters.

The sweetgum is absent from the bird's regular range, not occurring as native growth north of southern Connecticut, southeastern New York, West Virginia, southern Ohio, southern Illinois, southeastern Missouri, and Oklahoma. Contact between the two species, more than likely, then, is limited to invasion years. Since the time lapse between two consecutive invasions may well exceed the average life span of a bird as small as a crossbill, the periodic renewal of the sweetgum-crossbill association would seem to depend on birds which have had no previous invasion experience. Different generations of the species evidently can initiate the association anew, and indeed, judging from the parallel actions of birds in West Virginia and southern Illinois during 1965–66, separate bands participating in the same invasion can initiate it independently.

I have no evidence that the association is a historical one, innately resumed, or is not.

However, learned behavior possibly underlies it; if so, a glimpse of the learning process may be provided by the observed record of the species in southern Illinois, an area where mature conifers are not only relatively scarce but often impoverished. On six known occasions, beginning on 18 December, *L. leucoptera* appeared in a grove of ten introduced eastern hemlocks (*Tsuga canadensis*), and of other trees including one sweetgum, two miles north of the village of Cobden, Union County. The largest number of birds counted together was ten; the fewest, five; a solitary male once visited the grove. None was recorded out of the grove and accordingly any or all, without my knowledge, may have foraged continually in sweetgums elsewhere. My single record of such feeding occurred in the grove on 7 February during the visit of five birds. By then the hemlock seed crop had been much depleted. The birds nevertheless were first observed in the hemlocks. At this same time four goldfinches and one Pine Siskin (*Spinus pinus*, a rare winter visitant) fed in the sweetgum. Subsequently three crossbills joined this aggregation, all the species foraging in the manner described above. I have since speculated that perhaps the crossbills were attracted to the sweetgum less by the fruits in the branches than by the stimulus generated by the actions there of their cardueline kin. The characteristic foraging style of one cardueline surely would appear familiar to certain others. I accordingly suspect that the intermittent sweetgum-crossbill association may be an extension, in imitation, of the perpetual sweetgum-goldfinch one.

Another possible source of linkage between the bird and the tree is the appearance of the fruits themselves. While unconelike in structure, they present a set of conditions intermediate between those of pendulent cones among green branches and of the scaled fruits of alders (*Alnus*). This deciduous tree occurs within the regular range of *Loxia*; and its fruits hang in winter from bare branches.

In any case, detailed observations should be attempted on future invading White-winged Crossbills, particularly at points where south-moving expeditions first meet the sweetgums. Do the birds ignore the trees, do some heed them; and to what extent are the birds' later movements influenced by sweetgum distribution?—WILLIAM G. GEORGE, *Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901, 13 November 1967.*

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I certify that the statements made by me above are correct and complete. Signed. George A. Hall, Editor.