

PRECOCIOUS SEXUAL DEVELOPMENT IN THE JUVENAL ENGLISH SPARROW

By JOHN DAVIS

In the course of trapping English Sparrows (*Passer domesticus*) in the Los Angeles area in the summer of 1952, three juvenal males with enlarged testes were taken. Histologic examination of the gonads of these individuals showed that all three were in breeding condition.

In the descriptions of these juveniles, the following criteria of sexual maturity were used:

1. Bill color. The bill of *Passer domesticus* changes from light brown in sexually inactive males to black in breeding males (Keck, 1932:158-159).
2. Size of testes. Measurements of juvenal testes were compared with the following ranges in testis size noted in twelve breeding males in adult plumage and with ossified skulls, collected between June 3 and July 6, 1952: left testis, length, 6-8 mm., greatest diameter, 4-6 mm.; right testis, length, 6-7 mm., greatest diameter, 5-7 mm.
3. Histologic examination of testes. Testes were fixed in Bouin's fluid, prepared by the paraffin method, sectioned at 10 microns, and stained with Harris's hematoxylin and eosin. The histologic stages in testis development outlined by Bartholomew (1949:438) and Blanchard and Erickson (1949:266) were used as standards for comparison.

Descriptions of the juveniles.—Number 14. Live-trapped at 1646 North El Molino Avenue, Pasadena, Los Angeles County, California, on June 21, 1952, by Mrs. Harold Michener. Autopsied June 21, 1952. The skull was completely unossified. The plumage is juvenal except for two white-tipped black feathers on the throat, scattered chestnut and black, or buff and black, feathers on the dorsum and scapular regions, and a preponderance of the lesser coverts chestnut. The maxilla is dark brown, the mandible horn color, tinged and tipped with dark grayish brown. Although not black, the bill is noticeably darker than that of a juvenile with testes measuring 1 mm. trapped on July 6, 1952. The left testis measured 5.5×4 mm., the right testis 4.5×4 mm. Histologic examination of the testes showed an abundance of mature sperm with corkscrew-shaped acrosomes; the sperm were in bundles located at regular intervals along the radii of the tubules. This condition corresponds to class VI ("full spermatogenic activity with many sperm") of Bartholomew, and to stage 7 ("breeding") of Blanchard and Erickson.

Number 20. Live-trapped at 2134 Brawley Street, Los Angeles, Los Angeles County, California (this locality is 7 miles south-southeast of central Pasadena), on June 22, 1952, by William E. Mannatt and John Davis. Autopsied June 22, 1952. The skull was completely unossified. The plumage is mainly juvenal except for eight white-tipped black feathers on the chin and throat, six fresh gray feathers on the right side of the forehead, scattered buff and black feathers on the dorsum and scapular regions, and a preponderance of the lesser coverts chestnut. The entire bill is black (fig. 1). The left testis measured 6×4 mm., the right testis — $\times 4$ mm. (one end ruptured in removal). Histologic examination showed a condition similar to that described for number 14.

Number 22. Live-trapped at 2134 Brawley Street, Los Angeles, Los Angeles County, California, on July 6, 1952, by John Davis. Autopsied July 6, 1952. The skull was approximately one-fourth ossified. The plumage is juvenal except for six white-tipped black feathers on the throat, scattered buff and black, or chestnut and black, feathers on the dorsum and scapular regions, and all the lesser coverts chestnut. The chin feathers are being replaced, and the white tips of the new feathers are visible beyond their sheaths. The entire bill is black (fig. 1). The left testis measured 5×3 mm., the right testis 4×3 mm. Histologic examination of the testis showed a condition similar to that described for number 14.

DISCUSSION

The presence of juvenal male English Sparrows in full breeding condition during the normal breeding season of the species is difficult to explain. That this is not a local phe-

nomenon is indicated by two juvenal male *P. domesticus* in the University of California Museum of Vertebrate Zoology. Both were collected by the late Joseph Grinnell on the campus of the University of California, Berkeley, California. M.V.Z. no. 8373 is in heavily worn juvenal plumage with a few immature feathers. The specimen label bears the notation in Grinnell's handwriting "♂ ju. (testes very large!)." The bill is not black but dark brown, noticeably darker than the bills of other juveniles collected at Berkeley a few years later. The bird was collected on June 28, 1909. M.V.Z. no. 24758 is about one-third into the postjuvenal molt. Remiges and rectrices are heavily worn. The label bears the notation "♂ ju. Testes large =" and then follows a rough outline drawing of a testis which measures 3.5 mm. in longest diameter. The bill is pale and similar in color to that of the normal juvenile. The bird was collected on June 5, 1914. The advanced stage of molt, pale bill, and moderate size of the testis (if the outline drawing is accurate) suggest that this individual may have actually been in a state of sexual regression when it was collected. The incidence of precocious sexual development in juveniles collected 43 and 38 years ago at a locality over four hundred miles north of Los Angeles strongly suggests that this phenomenon is, and has been, of widespread occurrence in the Californian populations of *Passer domesticus*. It should also be remembered that the three precocious juveniles from the Los Angeles area were taken at localities seven miles apart.

It seems clear that the juvenal testis of the English Sparrow, under natural conditions, can undergo maximal development within the breeding season in which the juvenile hatched. It is to be wondered, then, why sexually mature juveniles do not form a more prominent part of the English Sparrow populations in California during the spring and summer months. Willett (1933:151) gives the breeding season of *Passer domesticus* in southwestern California as "at least from March to July." Grinnell and Wythe (1927:111) give the breeding season in the San Francisco Bay region as "at least from March to August." It is possible that during the nestling period nestlings are shielded from daylight by the location of the nest and brooding by the parents. Witherby *et al.* (1948:158) give the nestling period of the English Sparrow in Great Britain as 15 days. If this period is about the same in California young birds hatched as late as April 15 would leave the nest by May 1. Presumably, such fledglings would be exposed to daylight in the same measure as adults. Thus, by June 21, the longest day in the year, they would have been exposed to some 52 days of increasing day length during that part of the year that includes the longest days in the year. If the pituitary-gonad mechanism of these juveniles responded to photostimulation in the same fashion as this mechanism in adults, we should expect advanced sexual development in juveniles which had left the nest by May 1. Unfortunately, no records were kept of the numbers of juveniles trapped and released by me during June and July, 1952. About 100 juveniles were trapped, of which it may be assumed that one-half were males. Although the bill color of each juvenile was carefully examined before release, no sexually precocious individuals were found other than the three previously described. On the other hand, of 14 adults collected in June and July, 1952, 12 had completely black bills and enlarged testes. Two adults collected on July 7 and 31 were regressing sexually, but testis size and bill color showed that they had been in breeding condition. Two of nine juveniles collected at Berkeley in May and June are precocious, whereas all 15 adults collected at Berkeley during these months are dark-billed.

It seems apparent that sexually precocious juveniles exist in low numbers during the spring and summer months. This suggests that the juvenal pituitary, or testis, or both, differ markedly from those of the adult in their response to the stimuli leading to sexual development. What these differences are has not been established. However, Kirsch-

baum *et al.* (1939:255) state that the "testes of juvenal males are apparently capable of responding to gonadotropic substance at any time after hatching. Complete spermatogenic activity was induced by injections of pregnant mare serum during May and any time thereafter." The same authors (*op. cit.*:251) present in tabular form data showing that four male English Sparrows captured at New Haven, Connecticut, and aged by them as "fledglings," received daily injections of pregnant mare serum during May over periods ranging from 16 to 27 days. At autopsy, the bills of all individuals were black, the gonads were termed "active," and averaged 5.5×4.5 mm. These findings would

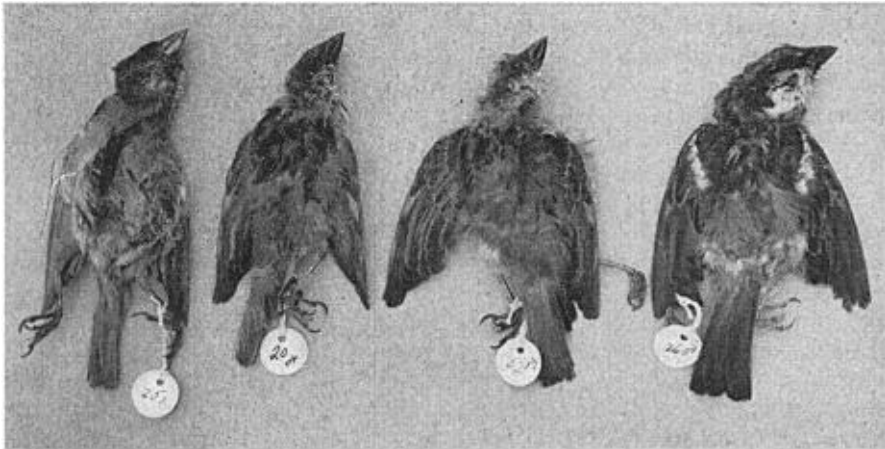


Fig. 1. Bill color of male English Sparrows. Left to right: normal juvenile no. 25, sexually mature juveniles nos. 20 and 22, and breeding adult no. 26.

indicate that the juvenal testis is capable of response in much the same fashion as the adult testis, and that it is the pituitary that is refractory.

The worn condition of the plumage of four of the five precocious juveniles discussed in this study suggests that they were hatched early, possibly during the late winter. It seems significant that of the three juveniles from the Los Angeles area, number 14, which has the least darkened bill, has only moderately worn plumage, whereas numbers 20 and 22, both black-billed, have heavily worn plumage, suggesting that they were fledged at an earlier date than number 14. Although the breeding season starts in California in March, it is not unreasonable to assume that there are occasional broods raised in January and February. Witherby *et al.* (*loc. cit.*) state that the breeding season begins in May in Great Britain, but that fresh eggs may be found "exceptionally in almost every month." Cottam (1929:193-4) reported a successful nesting at Provo, Utah, on January 1, 1929, with temperatures near 0°F . and snow on the ground. He also reported three nestings at the same locality in March, 1929, with subzero temperatures and heavy snowfall during that month. In the relatively mild climate of coastal California, it seems probable that some nesting occurs in the late winter months in that area. In my opinion, sexually precocious juveniles exist in low numbers because they result from sporadic breeding occurring well before the greater part of the English Sparrow population engages in nesting activity. I further believe that the pituitary of the juvenile is in some way less responsive to photostimulation than is that of the adult, and that only those juveniles hatched in the late winter, near the beginning of the period of increasing day length, will eventually be brought to a marked degree of sexual development.

It seems unlikely that sexually precocious juveniles form a part of the effective breeding population. First, there are obvious differences in plumage pattern and coloration between juveniles and adults, and these might well preclude the former from attracting mates. Second, there may possibly be behavioral differences between young and old birds which would be equally important in this regard. For example, of several hundred English Sparrows trapped between June and November, 1952, only a small proportion was adult. This extreme wariness on the part of adults has been encountered by others engaged in trapping this species and indicates that there are rather important behavioral differences between age groups.

Experimental zoologists working with samples of juvenal English Sparrows, especially in the warmer parts of the country, should realize that their supposedly pure samples of juveniles may include occasional individuals which have reached sexual maturity. Such birds would react to experimental manipulation as adults rather than as juveniles. Molting and black-billed juveniles should be eliminated from samples taken for experimental purposes during the spring and summer.

The problem is more difficult in the fall and early winter. There is no plumage character that will consistently separate adults from immatures when both are in fresh plumage. It is also possible that birds hatched as early as January and February might have fully ossified skulls by early fall, so that this criterion might not achieve complete separation of age classes. If the skulls were still not completely ossified, birds with a history of precocious sexual development could not be separated from normal immatures. It is suggested that, if occasional juveniles or immatures respond abnormally to experimental manipulation, the gonads of these birds be examined histologically to determine whether they resemble the gonads of adults taken at the same time of year.

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