Developing an Autosexing Columbian-patterened Variety of Chickens

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Autosexing varieties of chickens are those having a particular down color inheritance which allows easy separation of male and female chicks at hatching. The autosexing phenomenon relies upon the interaction of the gene Z^B, responsible for barred feathers and suitable down color patterns. Because of the well-known "double-dose" action of the sex-linked barring gene, homozygous male chicks of an autosexing variety appear light and "splotchy" in down color, while the homozygous female chicks are darker in down color than the males, and usually similar to the down color of the breed from which they were developed.

Punnett and Pease (1930) produced the first autosexing breed, the Cambars, by crossing Barred Plymouth Rocks with Golden Campines and making appropriate selections and backcrosses for several generations. Since 1930, many other autosexing varieties have been produced in England, such as Gold and Silver Legbars, Gold and Silver Dorbars, the Silver Welbar, Rhodebar, the Gold and Silver Brussbar, and the Brockbar. Jaap (1940) developed Gold Oklabars and Lamoreux (1941) developed the Ancobar in this country. Redbars (Hill and Lloyd, 1950) and Hampbars (Lloyd and Knight,1951) were developed in Canada. No doubt other autosexing varieties are being developed, but have not been reported in the literature.

The majority of autosexing breeds so far developed has consisted of superimposing the barring gene on a red or gold (Z^s) down color. In fact, Jaap (1941) has shown that the barring gene produces the clearest distinction between the sexes when it is superimposed on a "red-striped" down color. Silver Dorbars and Silver Cambars, which are silver (Z^S) in down color, have been bred by Punnett and Pease, but to our knowledge, no data are available on the accuracy with which the sexes can be distinguished at hatching. A silver-down-colored breed, the Silver Oklabar, has been tested for autosexing possibilities at the Oklahoma Station; the progress to date is reported in this bulletin.

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Origin of Silver Oklabars

Jaap, during his years at the Oklahoma Station, crossed White Plymouth Rock males on Rhode Island Red females. The barred red males of the F2 generation were mated to Dark Cornish females. The resulting progeny were mated among themselves, selection emphasis being on red-striped down color and superior body conformation. These birds were called Gold Oklabars. Silver-laced Wyandottes were then mated to Gold Oklabars and the barred-columbian progeny were selected for further breeding. These birds were called Silver Oklabars. For a more complete description of Silver Oklabars, see Godfrey and Thompson (1953).

Autosexing Tests, 1949-1955

Down Color Patterns

The Silver Oklabars were tested for autosexing possibilities from 1949 to 1950. It seems apparent that the problem of producing a silver autosexing breed is more difficult than producing a gold autosexing breed. In order for the barring gene to produce a visible effect upon the chick's down color, there must be enough black color present in the down upon which the barring gene may act.

In 1949, chicks which had black head and back stripes, or combinations thereof, at hatching were called females; those with a smoky neck were classified as males. About 79 percent of the chicks were silver or "white", and were not sexed at hatching. All chicks were sexed at 8 or 9 weeks of age by observing secondary sexual characters; if they died before that time, their sex was determined by an examination of the gonads.

During the hatching season of 1949, it was noted that there was considerable variation in the down pattern of the chicks. Therefore, in 1950 and 1951, all chicks were classified as to down pattern at hatching time. The results of this classification are shown in Table I.

Classifying those chicks which had head and/or back spots or stripes at hatching as females seemed to be justified. "Smoky-necked", and "smoky-neck and back" chicks can be classified as males at hatching. The discrepancies in classification may best be explained by the assumption that all chicks did not carry the barring gene. Figure 1 illustrates some of the "ideal" down color patterns. Not all patterns were as distinct as those illustrated, as anyone who has closely observed biological variations will realize.

TABLE I.—Accuracy of Sexing within Down Patterns in Silver Oklabars at Hatching Time.

Down Color or Pattern	1950				1951			
	No. Chicks	Percent Sexed Correct'y	Percent Males Called Females	Percent Females Called Males	No. Chicks	Percent Sexed Correctly	Percent Males Called Females	Percent Females Called Males
White	1403	Not sexed	--	--	1114	Not sexed	--	--
Smoky Neck	70	95.7	4.3	0	110	90.9	0	9.1
Head & back stripes	212	91.4	2.5	6.1	238	97.4	2.6	0
Head spot	180	87.2	0	12.8	250	98.3	1.7	0
Head stripe	160	92.3	0	7.7	151	98.6	1.4	0
Smoky neck & back	19	50.0	31.2	18.8	32	56.2	0	43.8
Head & back spots	25	100.0	0	0	6	100.0	0	0
Others	26	69.2	0	30.8	46	71.0	0	29.0

Autosexing Accuracy

Concurrently with this study of down-color patterns, selection for autosexing accuracy was practiced. Males with smoky necks or smoky backs as day-old chicks were mated to females which had head stripes or head and back stripes. Economic traits, such as egg production, growth rate, hatchability, rate of feathering, and livability were also incorporated into the selection program.

Table II shows the results of selection in improving autosexing accuracy. The percentage of sexable chicks has been improved from about 23 percent to around 70 percent. The overall sexing accuracy has been improved from about 22 percent to about 70 percent. These figures are not to the point where they would be commercially acceptable, but they do demonstrate that selection has increased the accuracy of autosexing within a barred-columbian variety.

It should be noted that progress from 1949 through 1954 was quite consistent, but that in 1955 there was a slight regression. This was probably due to a partial relaxation of selection pressure because some of the facilities used for this experiment were being turned over to other projects.

Relationship of Chick Down Color to Broiler Plumage Color

After several years of selection for autosexing accuracy, it became quite apparent that chicks of the autosexing line had a greater amount of black pigment in the columbian pattern than did Silver Oklabar chicks in a line not selected for autosexing accuracy (Production line).

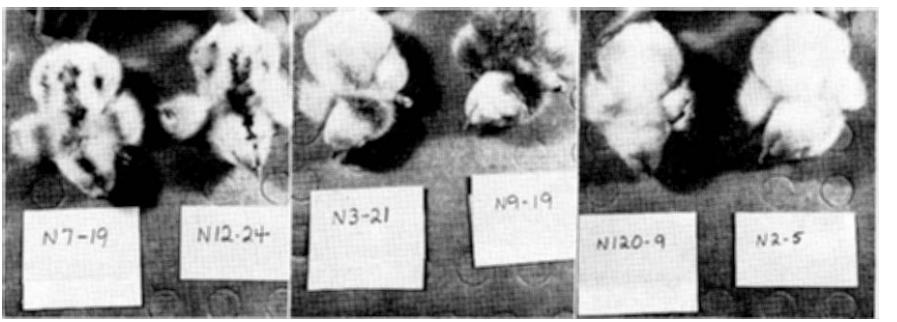

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Figure 1.—Some down color patterns of day-old chicks: (1) Both chicks have head and back stripes; (2) Chick on left has smoky neck, chick on right has smoky neck and back; (3) Both chicks are white.

Selection for autosexing accuracy resulted in a "dark" barred-columbian pattern, an effect which would be undesirable from the broiler grower's viewpoint.

Figures 2 and 3 show the differences in down color between the autosexing line and the production line, and between the nine-week plumage color of these two lines.

Problems Relating to Autosexing

The first and most obvious question is "Of what economic value is an autosexing breed"? If the costs of cloacal sexing could be saved, it would result in a saving to the hatcheryman and to the producer who buys sexed chicks. However, efforts by the breeder to produce autosexing varieties would have to be paid for, and thus, it is possible that no overall saving would result. It is well recognized that the larger the number of traits in a selection program, the slower will be the progress in any one trait. In all probability the autosexing characteristic is of only slight economic importance in comparison to the economic qualities of livability, egg production, hatchability, and growth. In this study livability and egg production were below the average of popular commercial strains.

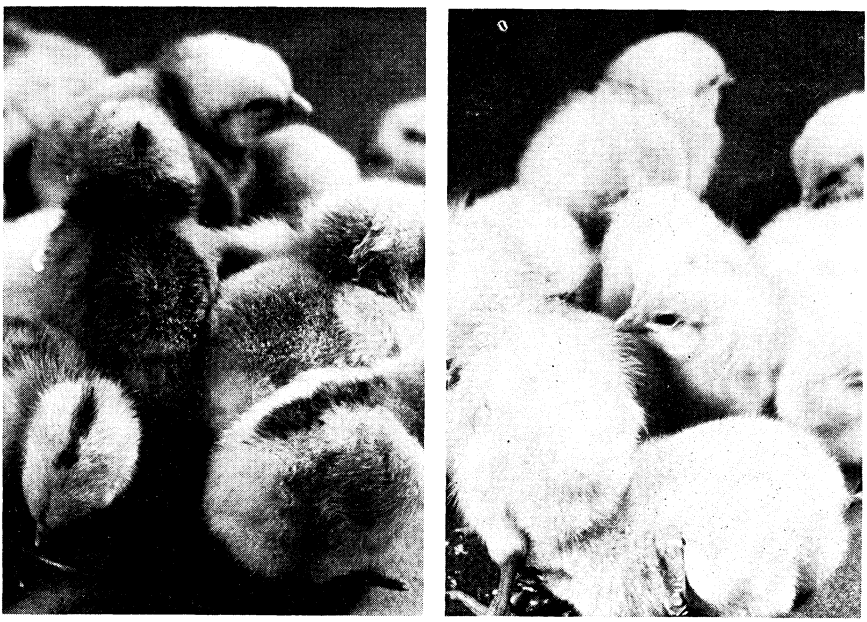

Figure 2.—Chick down color of day-old Autosexing line (left) and Production line (right).

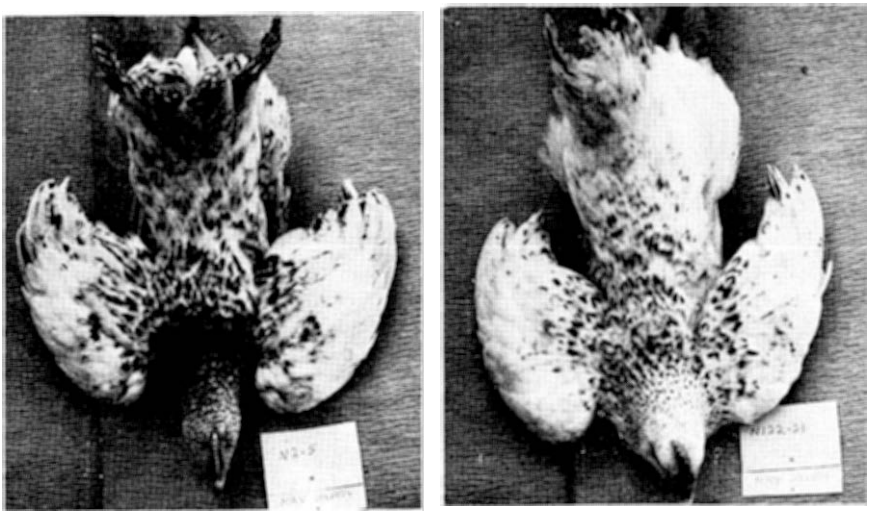

Figure 3.—Nine-week plumage color of Autosexing line (left) and Production line (right).

Warren (1953) has listed three factors which sum up the reasons for the failure of autosexing breeds to capitalize on their built-in advantage:

1. Their plumage color is not attractive, especially with the trend toward white-feathered broilers and layers.
2. None of the autosexing breeds has yet been developed to the point where they can compete successfully with present commercial breeds.
3. Any new breed, unless greatly superior to existing ones, must be highly promoted to popularize it.

The genetic problem involved in developing a silver autosexing breed is to build up sufficient "modifiers" for black in the down color so that the barring gene can produce visible manifestations of its action. This, in turn, brings up the problem of the relationship of down color to adult plumage color. Observations indicate that chicks showing considerable black in the down carry more black pigment in the adult plumage than is desired by the broiler industry. Jaap (1955) has shown that barred columbian birds, such as Silver Oklabars, tend to have greenish shanks and bluish color in the inner layers of the mid-ventral abdominal wall. The barring gene apparently causes these two defects, which are undesirable from the standpoint of meat production.

Table II.—Autosexing Accuracy in Silver Oklabars.

Year	Total No. Chicks	Percent Sexable	Percent Sexed Correctly	Percent Overall Accuracy
1949	1624	23.1	94.2	21.8
1950	2095	32.7	90.3	29.6
1951	1947	37.2	94.1	34.9
1952	586	50.3	89.8	45.2
1953	889	59.3	96.8	57.4
1954	823	75.4	95.7	72.2
1955	203	70.4	93.0	65.5

Summary

It has been demonstrated that selection can improve the autosexing accuracy of a barred-columbian-patterned chicken, the Silver Oklabar. Economically, the autosexing strain of Oklabar has little chance of becoming popular because selection for autosexing resulted in a dark-colored columbian pattern undesirable for broiler production. Its economic traits, such as livability and egg production, are below the averge of popular commercial strains.

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