Pine-barrens extend as far west as Texas, and there ought to be some species of pine-barren plants confined to Louisiana and Texas, but too little is known of the flora of those parts as yet.

Plants of muddy swamps seem from all accounts to be most numerous in the Mississippi embayment of the coastal plain, from about the mouth of the Ohio River southward. Characteristic species of this region, most of them woody plants, are:

Taxodium distichum, Echinodorus radicans, Arundinaria macrosperma, Hymenocallis occidentalis, Leitneria Floridana, Hicoria Pecan, H. aquatica, Quercus Michauxii, Q. lyrata, Planera aquatica, Celtis occidentalis, Brunnichia cirrhosa, Platanus occidentalis, Cratægus viridis, C. apiifolia, Amorpha fruticosa, Ilex decidua, Acer saccharinum (dasycarpum), Berchemia scandens, Nyssa uniflora, Bumelia lycioides, Adelia acuminata, Trachelospermum difforme, Asclepias perennis, Gonolobus lævis, Vincetoxicum gonocarpos, Bignonia cruciglia, Tecoma radicans, Conoclinium cœlestinum, Mikania scandens, Eupatorium serotinum.

Most of these are not wholly confined to the coastal plain, but they are more common there than elsewhere, and few if any of them ever ascend more than 1,000 feet above sea-level. Going eastward in the coastal plain they become perceptibly scarcer. There are fewer of them in Georgia than in Alabama, still fewer in the Carolinas, and only about half of them reach Virginia, though there is nothing in the climate to hinder them, as far as known.

In contrast to these five or six evident centers a few of the regions with poorer flora may be mentioned.

The coastal plain of Delaware, Maryland and Virginia seems to lack many of the species common to New Jersey and the southern pine-barrens, though some of them will probably be reported when those parts are better explored. South Carolina too seems to be a rather uninteresting state floristically, and there are perhaps no good species confined to it. The upper fourth of the coastal plain of Georgia (*i. e.*, that part outside of the pine-barrens) has quite a diversified topography and vegetation, but practically all the plants growing there range either northward to the mountains or coastward to the pine-barrens.

A part of the Cretaceous and Eocene regions of the coastal plain from western Alabama through northern Mississippi and West Tennessee to Kentucky is remarkable for the paucity of its flora. It is entirely outside of the pine-barrens, and nearly all of its species seem to be common and widely distributed. The same remarks will probably apply to the coastal plain of Arkansas.

The ultimate reason why so many species are found in some parts of the coastal plain and so few in others is still obscure, and perhaps each center will require a different explanation. But the importance of locating these centers is obvious; for any one who wishes merely to collect as many species as possible will save time by confining his operations to the vicinity of known centers, and the possibilities of discovering new species are greater there than in the poorer regions. When the species belonging to each center are more accurately listed it may then be possible to discover their significance.

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Secretary

DISCUSSION AND CORRESPONDENCE

INHERITANCE OF THE BELT IN HAMPSHIRE SWINE

THE Hampshires are a breed of black and white hogs, the white being confined to a belt around the body at the shoulders, sometimes occurring also on the hind feet and the tip of the tail. The breed has recently risen to prominence in the middle west. Its origin is somewhat obscure. Hogs of this peculiar coloring are seen occasionally throughout the south, north to the Ohio River, and even beyond. The white belt in hogs the breeding of which is left to chance behaves in a very erratic manner, usually occurring in only a small proportion of any herd. Even amongst registered Hampshires about 10 per cent. of the progeny is without the belt. Breeders have endeavored to eliminate the 'blacks,' *i. e.*, hogs lacking the belt, but are not yet able to avoid them. The writer recently undertook to collect data from breeders with a view to analyzing the belt character, and thus learning

the laws governing its inheritance. The effort has apparently been completely successful. The case is one of exceeding interest, and proves to be a complex case of Mendelian inheritance. There is some probability that it is a case of reversion to a very ancient type related to the Indian tapir, which is somewhat similarly colored. At first it was suspected that the belt was due to a simple Mendelian character. According to the testimony of breeders, when two belted hogs produce black progeny there is a distinct tendency for one fourth of the litter to be black. Also, when a belted animal is bred to a black, two cases are evident: first, the litter may all be belted; second, in some cases there is a distinct tendency for half the litter to be belted and half black. Thus far, we seem to be dealing with a simple character pair. But all breeders agree that black bred to black does not always produce black. In fact, litters of this breeding may be all belted.

Professor Castle accounts for the agouti color in guinea pigs by supposing a third independent character which governs the arrangement of the red pigment in the hair, so that the black and red pigments together, under the influence of this third character, produce the agouti color. We can fully explain the peculiarities of the inheritance of the belt character in Hampshire swine by a somewhat similar assumption. In this case, however, this third character, which governs the distribution of white and black over the body, is a compound character of two factors. Representing the two factors by *F* and *G*, and the two colors by *W* and *B*, the allelomorphic formula of a pure belted individual is *FF, GG, WW, BB*. The individuals lacking the belt have white fore feet, so that *W* and *B* are present throughout the breed. We may, therefore, omit *W* and *B* in our formulæ. If either *F* or *G* is entirely absent the belt fails to appear. Representing the absence of either *F* or *G* by *O*, the following nine types are possible, and doubtless occur in the breed:

TABLE I.

a. *FFGG*, producing gametes *FG*.
b. *FFGO*, producing gametes *FG, FO*.
c. *FOGG*, producing gametes *FG, OG*.
d. *FOGO*, producing gametes *FG, FO, OG, OO*.
e. *FFOO*, producing gametes *FO*.
f. *FOOO*, producing gametes *FO, OO*.
g. *OOGG*, producing gametes *OG*.
h. *OOGO*, producing gametes *OG, OO*.
i. *OOOO*, producing gametes *OO*.

Types *a*, *b*, *c* and *d* are belted; the others are not.

Table II. shows the proportion of 'blacks' in the progeny of all the possible conjugations of these nine types.

TABLE II.

Percentage of Blacks in the Various Conjugations.

Types	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
a	0	0	0	0	0	0	0	0	0
b		25	0	25	50	50	0	25	50
c			25	25	0	25	50	50	50
d				43+	50	62+	50	62+	75
e					100	100	0	50	100
f						100	50	25	100
g							100	100	100
h								100	100
i									100

Table II. may be divided into three sections, as shown by the division lines. The first section shows the results that follow when belted hogs of all types are bred together. Of the ten possible types of breeding in this division five result in no blacks, four give 25 per cent. blacks, and one 43+ per cent. Breeders have already recognized all these except the last, which occurs in only one out of ten possible cases.

In the second section of the table are found the results from breeding belted hogs on blacks. Of the twenty cases seven give all belts; eight give 50 per cent. blacks; two give 25 per cent. blacks; two 62+ per cent; and one gives 75 per cent. blacks. The results which occur most commonly have both been recognized by breeders, namely, cases giving 100 per cent. belts, and those giving 50 per cent. blacks. The remaining cases occur so seldom that they have not been recognized.

The third section of the table displays the results from breeding black on black. Of the fifteen cases, eleven give blacks only, two give 50 per cent. blacks, one gives 25 per cent.

blacks and one gives 100 per cent. belts! These results are in accord with the experience of breeders, and explain this experience completely.

How shall the breeder proceed to eliminate the undesirable blacks? If a single dominant unit character were to be bred pure, the way to do this would be to discard both parents when black pigs occur. This would rapidly reduce the number of black pigs produced. But here we desire to perpetuate two dominant characters. The desired result will ultimately be secured by discarding both parents of all black pigs farrowed, but very slowly; for heterozygotes are not always revealed by breeding them together. For instance, types *b* and *c* bred together produce only belted pigs. Neither can we test out the heterozygotes by breeding to blacks, for in many cases this type of breeding gives only belts. We can, however, determine whether an individual is homozygous by breeding to a breed which possesses neither of the factors *F* and *G*. Only type *a* thus bred will give all belts. But here a difficulty arises. One or the other of these factors is present in at least four other breeds. This is demonstrated by the fact that when Tamworths are crossed on Chester whites, and when Duroc-Jerseys are crossed on Yorkshires, the belt sometimes appears in part or all the progeny. It is not yet known whether Berkshires and Poland Chinas possess either of these factors.

The presence of the factors *F* and *G* in four of our standard breeds accounts fully for the occasional occurrence of 'listed' (belted) hogs in swine of mixed breding, a not uncommon occurrence in sections where mixed breeding is common.

The fact that some breeds possess the factor *F* and others the factor *G*, unsuspected until revealed by the numerous breed crosses made by Mr. Q. I. Simpson, hints at the possibility that at some remote time the ancestors of our domesticated swine were belted after the manner of the related Indian tapir, and that the belt disappeared by the gradual weakening of factor *F* in some cases and of factor *G* in others. In America, where our swine trace to breeds from all parts of the world, these factors have been brought together again, renewing this striking belt character. It is suggested that the Tamworths and Yorkshires probably carry the same factor, these breeds both coming from England. Chester whites and Duroc-Jerseys originated in America, and possibly inherited the other factor from the Chinese hog, which entered into most of our early breeds.

It is entirely possible that the belt character is more complex than here indicated. However, the difference between belted and black Hampshires evidently relates to two factors only.

The distribution of black and white in Berkshires and Poland Chinas is evidently governed in a manner similar to that above assumed for Hampshires, though it is not known how many factors are concerned. These two breeds are black with white 'points.' Until recently Poland Chinas were black and white spotted. The presence of a few animals in the breed having the black color with white points furnished the factor or factors that ultimately gave the breed its present color type.

It is suggested that the arrangement of color on all spotted animals may be governed in some such manner as that here indicated. The presence of several factors having this relation to color distribution, and scattered promiscuously through a spotted breed, would account for observed facts. The tendency for color spots to appear in definite places, as black on the rump in swine having most of the body white, a very persistent tendency, the localization of spots on fox terriers, and the strong tendency for red hairs to appear about the ears of white cattle, all point in this direction.

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WING VEINS OF INSECTS

AN adequate reply correcting all the misstatements occurring in the review[1] in SCIENCE of February 8, of my article on wing veins would be beyond the limits of space available for this article, and I shall have to

[1] Pp. 219–229.