

and susceptibility or resistance to rust-disease in wheat, to mention only a few.

So far, we have considered the case of only one pair of differentiating characters in an individual, but the same results occur in the case of any number of pairs of characters. In the case of two pairs of differentiating characters we get in the first generation of the hybrids individuals all showing the two dominant characters. In the second generation we get nine individuals showing both dominants, three showing one dominant and one recessive, three showing the other dominant and the other recessive, and one showing both recessives. But it is not so easy to trace the results when there are several interacting factors modifying the same part or structure, or when the factors concerned fail to correspond with the characters that appear in the zygote, such as factors for inhibiting or developing color.

Further complications are met with as the result of the repulsion and coupling of certain factors, including sometimes the factors for sex, the inheritance of which in some cases it appears to be possible to express in Mendelian terms. It is often hard to trace the inheritance of utility characters because they frequently are the result of many factors with differences so fine that they can hardly be recognized.

The study of Mendelism in the bee is hampered by several special difficulties. First, we cannot control mating in the ordinary way. Then there is the parthenogenetic production of the drone, which is likely to have a disturbing effect. Thirdly, the honey-bee is a highly-specialized animal, and varies very little. There is some variation in size, the eastern races being smaller than those of the west, but apart from this the color of the upper or dorsal side of the abdomen is the only visible character that varies strikingly. The

variation consists in the extent to which the two colors, yellow and black, displace one another.

Turning our attention, firstly, to the workers, we find that in *Apis indica*, in the Abyssinian bee, and in the artificial varieties known as golden bees, the yellow extends over the three basal segments, and more or less of the basal part of the fourth segment. The scutellum on the posterior part of the thorax is also yellow. Extreme goldens, with the fourth segment entirely, and the fifth segment more or less, yellow, have also been bred, but it appears that they do not breed true. In Italians the three basal segments are bordered at the edges with black and the scutellum is darker. Italians from the Swiss Alps have the black bands wider than Italians from the Ligurian Alps, while Cyprians have them narrower. Races with the abdomen entirely black occur in Britain, France, Germany, Malta, and other places. For some years I have been engaged in breeding a golden bee known as the British golden bee. This bee was extracted from crosses between English blacks, Italians and American goldens. The golden character was soon isolated, and thenceforward it was found possible to maintain the pure golden breed, though, as may be imagined, many of the queens were mated with blacks and produced hybrids. No attempt was made to increase the area of the golden color. The diagram (Fig. 1) shows the coloring of the abdomen of a pure British golden worker. It is interesting to compare this with Fig. 4, which is the coloring of the abdomen of a pure British golden queen. It will be seen that the yellow in the queen extends much further than in the worker. The factor,* or factors, that produce a half yellow and half black abdomen in the worker produce an almost entirely yellow one in the queen. There

*The word "factor" is here used in the Mendelian sense only.

December, 1912

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