

3. Color differences in the sexes of a crab.

By E. A. Andrews, Johns Hopkins University, Baltimore Md.

(With 2 figures.)

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In crustacea the male and female may be easily distinguished, generally by differences in form and organization, but not by differences in color.

The sexes differ not only in the essential organs, testes and ovaries, in the passageways from these organs to the exterior and in the external openings, but also, commonly, in many or fewer organs directly concerned with the transfer and reception of sperm and again in the organs concerned in the carrying or protection of the eggs. Most of the external differences between male and female may be referred to one or the other of these categories; either they relate to the bringing of sperm and egg together or else to the care of the eggs. A marked difference in the size and shape of the claws is often connected with the mode of sperm transfer and may be so in cases in which at present evidence is lacking as to any meaning of the great claws of the male. There remains, in some crustacea, the differences in size of the entire animal, which may be very striking, yet have no apparent value with reference to sperm transfer or to care of eggs. Here again some more or less direct connection with these necessary acts may be suspected.

As a rule the sexes in crustacea have the same coloration, but a few exceptions have been noted amongst the highest forms. Thus Conn, in the J. H. University Circulars, 1883, cites Darwin as knowing of but two cases of color differences in crustacea, *Squilla stylifera* and a species of *Gelasimus*. Conn then describes the remarkable intensity and special distribution of blue color on the great claws of the male of another crab, the common *Calinectes* of the Chesapeake, as contrasted with the orange color or less brilliant blue of the like parts of the female.

To these instances may be added the case of the mud crabs, *Neopanope texana* (Stimpson) as mentioned by Benedict and Rathbun, Proc. Nat. Mus. XIV. 1891. p. 363—364, in which the finger tip of the claw of the male is lighter than in the female, in a subspecies, but much darker in the type.

While other cases may have escaped review the following is sufficiently novel to be worthy of notice.

At Montego Bay, Jamaica, B.W.I. the Marine Laboratory of the Johns Hopkins University found a wealth of crustacean forms and amongst them the large hermit crab, *Petrochirus bahamensis* (Herbst

living in the shells of the common conch, *Strombus gigas*. In one of these shells was found in August 1910 a pair of crabs, *Porcellana sayana* (Leach), living as commensals with the big hermit crab. These small crabs were at once recognized as different in color markings and one proved to be a female bearing eggs on the abdominal appendages and the other a male.



Fig. 1 u. 2. Photograph of male and female *Porcellana sayana* (Leach, taken with an enlargement of two diameters.

The general color of the shell of these crabs was yellowish red: upon this ground color were scattered numerous round spots of creamy white, each spot sharply circumscribed by a narrow line of red, much darker than the background. The pattern thus produced suggested oil drops floating side by side or some physical arrangement of foam rather uniform and symmetrical over the whole animal.

The male differed from the female not only in the size and shape

of the abdomen and character of the sperm- transferring appendages but in the greater size of the chelae, as seen in the accompanying figure which is from a photograph of the male and female. The spots on the carapace of the male had the same arrangement as in the female but were a little smaller in general so that more of the background showed between them, that is they were not crowded as closely as in the female.

The striking color factor was, however, the presence of blue in the male and not in the female. Certain of the rounded spots had in the male an intermediate area of sky-blue between the central white and the peripheral red line. This blue made these spots very conspicuous. The blue color was often to some extent shaded toward the centre so that one was reminded of the »eye spots« on the wings of insects and feathers of birds. The amount of blue was different in different spots and might make but a slender rim within the red line, or nearly cover the entire centre of the spot.

To represent these spots in the photograph it was found expedient to darken them with ink, so that the upper figure in the photograph shows pretty accurately the number and distribution of all the spots in the male that had blue in them, as none are found on the ventral face of the animal, but it does not represent the amounts of blue in the different spots. It will be noted that blue spots are found on the limbs right and left rather symmetrically and on the carapace with some departures from symmetry, which is also true of the more numerous spots without blue.

While the male is thus easily recognized by its blue rings there is no evidence that this fact is of any importance to the animal. In this apparently monogamous animal living protected or concealed in the shell that forms its host's house it would be only some peculiar and unknown habits that might make the blue color valuable. The real significance of this concomitant occurrence of blue color and male sex may not have any reference to the surface of the animal.

As the blue color disappears in alcoholic specimens it has not been seen in museum specimens and this suggests there may be many cases of sexually limited coloration in crustacea that have thus escaped notice. A comparative study of live crustacea might discover more cases of such coloring and suggest lines of investigation as to their meaning.

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Autor(en)/Author(s): Andrews E.A.

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