

LOCAL VARIATIONS IN THE COLOUR PATTERN OF THE PRAWN *LEANDER* *SERRATUS* (PENNANT)

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(Text-figs. 1-2)

During investigations into the endocrinology of *Leander* (= *Palaemon*) *serratus* (Pennant) several differences in physiology (which will be reported in this *Journal* at a later date) have been found between the prawns from Plymouth and those from Roscoff on the north coast of France. These experiments involved the repeated handling and the close examination of about a thousand prawns from Roscoff and many more from Plymouth. Increasing familiarity with these animals led to the realization that the two samples could readily be distinguished by eye. It was not always possible to determine the provenance of a single individual in this way, but any group of five or six could be told at a glance. A detailed examination of the external morphology showed that the characteristic differences by which the provenance of these animals could be determined lay not in any anatomical feature but in the disposition and arrangement of the chromatophores which form the pattern on the dorsal side of the cephalothoracic shield and the anterior part of the abdomen. Great individual variations were to be seen, but differing trends of development of the patterns were found in the two populations. There was some degree of overlap between the populations, but only about 15% of the prawns lay in this region of overlap and thus failed to bear the marks of their locality; the remaining 85% could be assigned to either Roscoff or Plymouth with little difficulty. Recently I have been able to examine about forty prawns from Concarneau, on the Atlantic coast of France, and these again are mostly different from either of the other two samples.

The colour pattern of *Leander* is formed by an arrangement of vari-coloured chromatophores of different types. Most of the body is covered by a groundwork of scattered, small, red and yellow, bichromatic chromatophores. Bands of deeper colour are formed by the closer massing of larger, physiologically different, bichromatic, red and yellow chromatophores which appear to contain the same pigments, but react differently to hormones. Placed singly are large, white, light-reflecting chromatophores, which also are bichromatic, possessing a relatively inconspicuous red component. Colour photographs illustrating some of these chromatophore types will be found in

Knowles (1955) and Knowles, Carlisle & Dupont-Raabe (1955). Many of the chromatophores on the legs, and some on the uropods, are monochromatic and in these parts patterns exist which are differently compounded from those on the body, but with these regions we are not now concerned. The marked differences between individuals and populations are to be found most noticeably in the dispositions of the bands of colour and the single white chromatophores on the anterior part of the body.

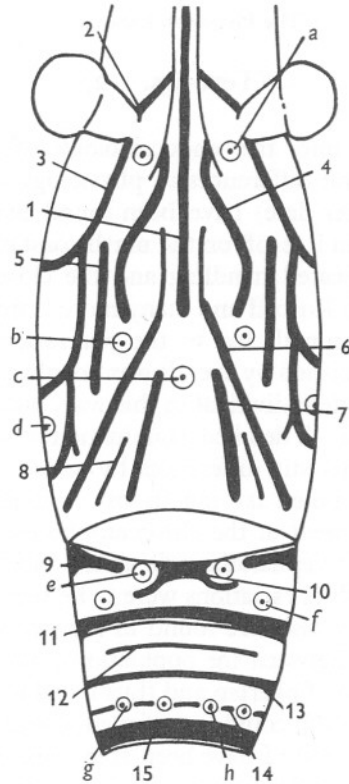


Fig. 1. Diagram of the arrangement of the bands of large chromatophores and the single white chromatophores on the dorsal side of the cephalothorax and the first two abdominal segments. 1-15, the bands of large chromatophores; a-h, the white chromatophores.

An arrangement of the bands and the white chromatophores which can be considered a basic pattern from which the variants diverge is represented diagrammatically in dorsal view in Fig. 1. The heavy black lines represent the bands of large, red and yellow bichromatic chromatophores, the circles the white, reflecting chromatophores, with the red component as a dot in the centre. This pattern, or something very like it, can be seen in many individuals from all three localities which have been investigated, particularly in the

younger prawns. In the smaller animals it may be simplified by the omission of white chromatophores *e* and bands 9 and 10.

The main variations on this pattern take the form of reduction or suppression of certain parts or the anastomosis of bands. Asymmetry is very common: indeed, marked asymmetry seems to be more common than near symmetry.

In prawns from Plymouth one of the most constant features is the duplication, as in Fig. 2A-C, of white chromatophore *c*. This occurs in about 80% of individuals. Bands 7 from left and right frequently anastomose in front of chromatophore *c*, rarely behind. Band 1 is usually joined with either bands 6 or bands 7. The lateral horns of band 10 on the first abdominal tergite often continue round chromatophores *e* and fuse with bands 9. Band 14 and the associated chromatophores *g* and *h* may be reduced or absent. Plymouth prawns have a much greater tendency than any of the French animals to complicate the pattern by arabesques, such as are illustrated in Fig. 2B, C.

Among prawns from Roscoff only a small proportion, about 20%, shows the duplication of chromatophore *c* which is so common in prawns from Plymouth. The lateral horns of band 10 do not continue round chromatophores *e* to fuse with band 9. The main variants from the standard pattern are the suppression or great reduction in most individuals of bands 8; the frequent anastomosis of bands 7 behind chromatophore *c*, never in front of it; the reduction or interruption of bands 12 and 14, with often an increase in number of chromatophores *g* and *h* (Fig. 2E); and occasionally anastomosis of band 1 with either or both of bands 6.

In prawns from Concarneau there was a great tendency for the bands to be broken up into dotted lines, especially the narrower bands (e.g. Fig. 2G). Bands 7 usually anastomosed both before and behind chromatophore *c*, so that it came to lie in a ring. Band 1 never fused with bands 6, but did so sometimes with bands 7. The lateral horns of band 10 were often prolonged to run towards chromatophores *f* and frequently a small transverse band was developed in the mid-line between bands 10 and 11 (Fig. 2G-J). This is quite different in appearance from the slight longitudinal bar which may be present in the same position in prawns from Plymouth (Fig. 2C).

Many other individual variations may occur, but these listed above seem to be most constant in the three populations and serve best to distinguish them. Individual variations which occur in all three populations are shifts in position of chromatophores *d* so that they may not be visible in a strictly dorsal view; the appearance of an extra white chromatophore somewhere on the cephalothorax, particularly in the mid-line towards the posterior edge (Fig. 2E); or the absence of one or more of these (e.g. *b* on the right side in Fig. 2H).

It must be emphasized that these differences are described on the basis of relatively small samples of several hundred animals only (many less in the Concarneau sample). Moreover, there is the possibility that the general aspect at each locality may shift year by year. The descriptions above, and all

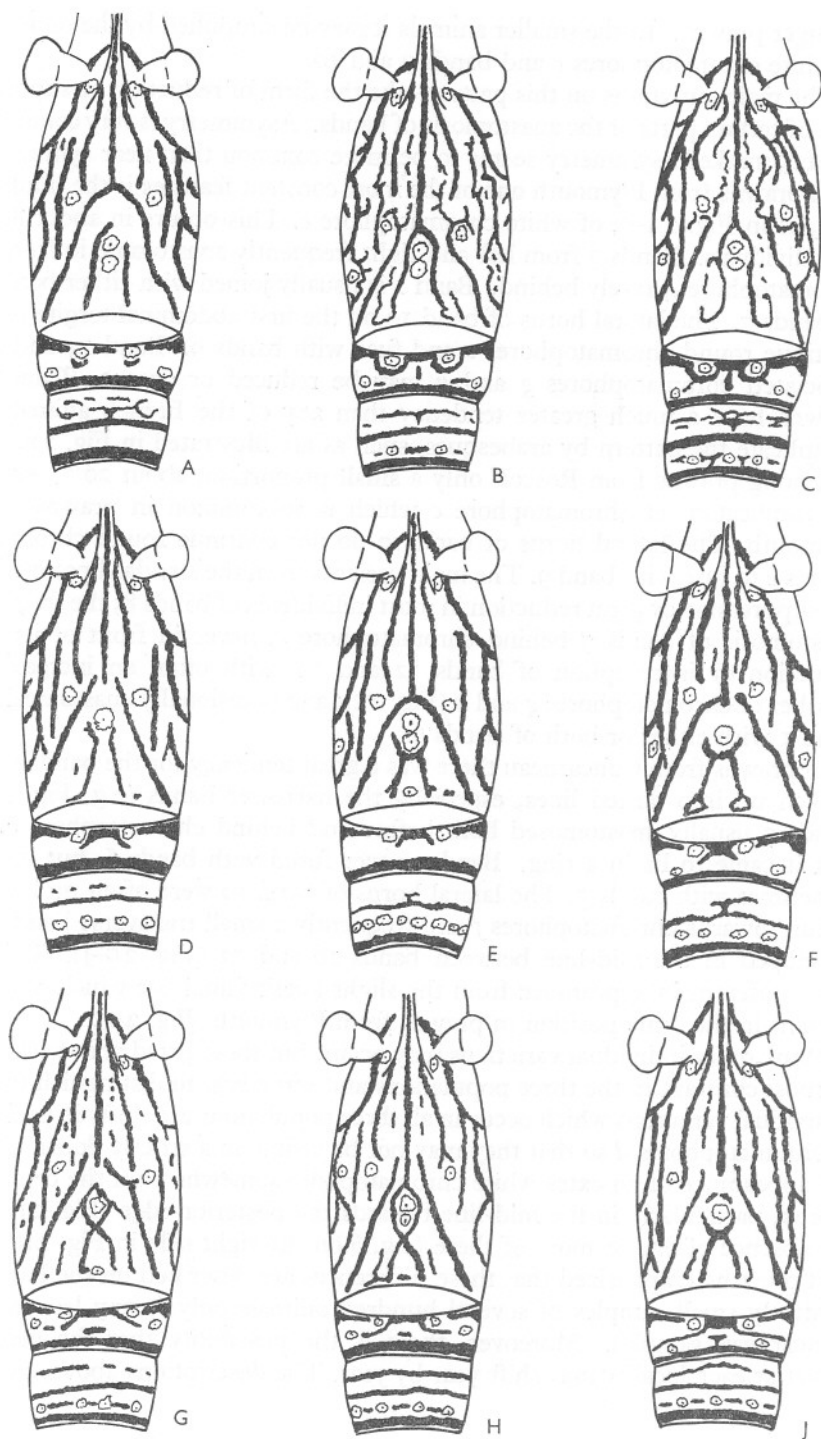


Fig. 2. Sketches in dorsal view of the patterns of colour on the cephalothorax and first two abdominal segments of female prawns of 50–55 mm overall length (rostrum to telson). A, B, C, prawns from Plymouth; D, E, F, prawns from Roscoff; G, H, J, prawns from Concarneau.

the drawings, refer particularly to females between 50 and 55 mm in length (rostrum to telson), and in smaller animals the pattern is often simplified or nearer to the standard. But even in the smallest post-larva at Plymouth the main characteristic variations can be distinguished in a proportion of individuals.

There appears to be no reason for regarding these differences as subspecific variations; it is more probable that every locality which is sufficiently isolated will show characteristic variations. The barriers which separate the three localities which I have studied are well pronounced and may form almost complete blocks in the interchange of population. They are, of course, the English Channel, and Cape Finistère and Ushant. In cross-breeding experiments with the populations from Roscoff and Plymouth there has been no depression in the fertilization rate, in the speed at which eggs are laid or in the viability of the eggs. I have reared the F_1 generation from reciprocal crosses as far as the first post-larval stage, but the numbers so far have been too few to draw any conclusions about the genetical basis of the pattern variations.

SUMMARY

Characteristic differences in the colour patterns of prawns from Roscoff, Concarneau and Plymouth are described and figured. There is no sign of any sterility between the populations from Roscoff and Plymouth.

REFERENCES

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- KNOWLES, F. G. W., CARLISLE, D. B. & DUPONT-RAABE, M., 1955. Studies on pigment activating substances in animals. I. The separation by paper electrophoresis of chromactivating substances in arthropods. *J. Mar. biol. Ass. U.K.*, Vol. 34, pp. 611-35.