

SECONDARY SEXUAL CHARACTERS IN THE LOWER CLASSES  
OF THE ANIMAL KINGDOM.

WITH animals belonging to the lower classes, the two sexes are not rarely united in the same individual, and therefore secondary sexual characters cannot be developed. In many cases where the sexes are separate, both are permanently attached to some support, and the one cannot search or struggle for the other. Moreover it is almost certain that these animals have too imperfect senses and much too low mental powers to appreciate each other's beauty or other attractions, or to feel rivalry.

Hence in these classes or sub-kingdoms, such as the Protozoa, Coelenterata, Echinodermata, Scolecida, secondary sexual characters, of the kind which we have to consider, do not occur: and this fact agrees with the belief that such characters in the higher classes have been acquired through sexual selection, which depends on the will, desire, and choice of either sex. Nevertheless some few apparent exceptions occur; thus, as I hear from Dr. Baird, the males of certain Entozoa, or internal parasitic worms, differ slightly in colour from the females; but we have no reason to suppose that such differences have been augmented through sexual selection. Contrivances by which the male holds the female, and which are indispensable for the propagation of the species, are independent of sexual selection, and have been acquired through ordinary selection.

Many of the lower animals, whether hermaphrodites or with separate sexes, are ornamented with the most brilliant tints, or are shaded and striped in an elegant manner; for instance, many corals and sea-anemones (*Actiniae*), some jelly-fish (*Medusae*, *Porpita*, &c.), some *Planariae*, many star-fishes, *Echini*, ascidians, &c.; but we may conclude from the reasons already indicated, namely, the union of the two sexes in some of these animals, the permanently affixed condition of others, and the low mental powers of all, that such colours do not serve as a sexual attraction, and have not been acquired through sexual selection. It should be borne in mind that in no case have we sufficient evidence that colours have been thus acquired, except where one sex is much more brilliantly or conspicuously coloured than the other, and where there is no difference in habits between the sexes sufficient to account for their different colours. But the evidence is rendered as complete as it can ever be, only when the more ornamented individuals, almost always the males, voluntarily display their attractions before the other sex; for we cannot believe that such display is useless, and if it be advantageous, sexual selection will almost inevitably follow. We may, however, extend this conclusion to both sexes, when coloured alike, if their colours are plainly analogous to those of one sex alone in certain other species of the same group.

How, then, are we to account for the beautiful or even gorgeous colours of many animals in the lowest classes? It appears doubtful whether such colours often serve as a protection; but that we may easily err on this head, will be admitted by every one who reads Mr. Wallace's excellent essay on this subject. It would not, for instance, at first occur to any one that the transparency of the *Medusae*, or jelly-fish, is of the highest service to them as a protection; but when we are reminded by Haeckel that not only the *Medusae*, but many floating *Mollusca*, crustaceans, and even small oceanic fishes partake of this same glass-like appearance, often accompanied by prismatic colours, we can hardly doubt that they thus escape the notice of pelagic birds and other enemies. M. Giard is also convinced\* that the bright tints of certain sponges and ascidians serve as a protection. Conspicuous colours are likewise beneficial to many animals as a warning to their would-be devourers that they are distasteful, or that they possess some special means of defence; but

this subject will be discussed more conveniently hereafter.

\* Archives de Zoolog. Exper., Oct., 1872, p. 563.

We can, in our ignorance of most of the lowest animals, only say that their bright tints result either from the chemical nature or the minute structure of their tissues, independently of any benefit thus derived. Hardly any colour is finer than that of arterial blood; but there is no reason to suppose that the colour of the blood is in itself any advantage; and though it adds to the beauty of the maiden's cheek, no one will pretend that it has been acquired for this purpose. So again with many animals, especially the lower ones, the bile is richly coloured; thus, as I am informed by Mr. Hancock, the extreme beauty of the Eolidae (naked sea-slugs) is chiefly due to the biliary glands being seen through the translucent integuments- this beauty being probably of no service to these animals. The tints of the decaying leaves in an American forest are described by every one as gorgeous; yet no one supposes that these tints are of the least advantage to the trees. Bearing in mind how many substances closely analogous to natural organic compounds have been recently formed by chemists, and which exhibit the most splendid colours, it would have been a strange fact if substances similarly coloured had not often originated, independently of any useful end thus gained, in the complex laboratory of living organisms.

The sub-kingdom of the MOLLUSCA.- Throughout this great division of the animal kingdom, as far as I can discover, secondary sexual characters, such as we are here considering, never occur. Nor could they be expected in the three lowest classes, namely, in the ascidians, Polyzoa, and brachiopods (constituting the Molluscoidea of some authors), for most of these animals are permanently affixed to a support or have their sexes united in the same individual. In the Lamellibranchiata, or bivalve shells, hermaphroditism is not rare. In the next higher classes of the Gasteropoda, or univalve shells, the sexes are either united or separate. But in the latter case the males never possess special organs for finding, securing, or charming the females, or for fighting with other males. As I am informed by Mr. Gwyn Jeffreys, the sole external difference between the sexes consists in the shell sometimes differing a little in form; for instance, the shell of the male periwinkle (*Littorina littorea*) is narrower and has a more elongated spire than that of the female. But differences of this nature, it may be presumed, are directly connected with the act of reproduction, or with the development of the ova.

The Gasteropoda, though capable of locomotion and furnished with imperfect eyes, do not appear to be endowed with sufficient mental powers for the members of the same sex to struggle together in rivalry, and thus to acquire secondary sexual characters. Nevertheless with the pulmoniferous gasteropods, or land-snails, the pairing is preceded by courtship; for these animals, though hermaphrodites, are compelled by their structure to pair together. Agassiz remarks, "Quiconque a eu l'occasion d'observer les amours des limacons, ne saurait mettre en doute la seduction deployee dans les mouvements et les allures qui preparent et accomplissent le double embrassement de ces hermaphrodites."\* These animals appear also susceptible of some degree of permanent attachment: an accurate observer, Mr. Lonsdale, informs me that he placed a pair of land-snails (*Helix pomatia*), one of which was weakly, into a small and ill-provided garden. After a short time the strong and healthy individual disappeared, and was traced by its track of slime over a wall into an adjoining well-stocked garden. Mr. Lonsdale concluded that it had deserted its sickly mate; but after an absence of twenty-four hours it returned, and apparently communicated the result of its successful exploration, for both then started along the same track and disappeared over the wall.

Even in the highest class of the Mollusca, the Cephalopoda or cuttle-fishes, in which the sexes are separate, secondary sexual characters of the present kind do not, as far as I can discover, occur. This is a surprising circumstance, as these animals possess highly-developed sense-organs and have considerable mental powers, as will be admitted by every one who has watched their artful endeavours to escape from an enemy.\* Certain Cephalopoda, however, are characterised by one extraordinary sexual character, namely that the male element collects within one of the arms or tentacles, which is then cast off, and clinging by its sucking-discs to the female, lives for a time an independent life. So completely does the cast-off arm resemble a separate animal, that it was described by Cuvier as a parasitic worm under the name of Hectocotyle. But this marvellous structure may be classed as a primary rather than as a secondary sexual character.

\* See, for instance, the account which I have given in my Journal of Researches, 1845, p. 7.

Although with the Mollusca sexual selection does not seem to have come into play; yet many univalve and bivalve shells, such as volutes, cones, scallops, &c., are beautifully coloured and shaped. The colours do not appear in most cases to be of any use as a protection; they are probably the direct result, as in the lowest classes, of the nature of the tissues; the patterns and the sculpture of the shell depending on its manner of growth. The amount of light seems to be influential to a certain extent; for although, as repeatedly stated by Mr. Gwyn Jeffreys, the shells of some species living at a profound depth are brightly coloured, yet we generally see the lower surfaces, as well as the parts covered by the mantle, less highly-coloured than the upper and exposed surfaces.\* In some cases, as with shells living amongst corals or brightly-tinted seaweeds, the bright colours may serve as a protection.\*(2) But that many of the nudibranch Mollusca, or sea-slugs, are as beautifully coloured as any shells, may be seen in Messrs. Alder and Hancock's magnificent work; and from information kindly given me by Mr. Hancock, it seems extremely doubtful whether these colours usually serve as a protection. With some species this may be the case, as with one kind which lives on the green leaves of algae, and is itself bright-green. But many brightly-coloured, white, or otherwise conspicuous species, do not seek concealment; whilst again some equally conspicuous species, as well as other dull-coloured kinds live under stones and in dark recesses. So that with these nudibranch molluscs, colour apparently does not stand in any close relation to the nature of the places which they inhabit.

\* I have given (Geological Observations on Volcanic Islands, 1844, p. 53) a curious instance of the influence of light on the colours of a frondescent incrustation, deposited by the surf on the coast-rocks of Ascension and formed by the solution of triturated sea-shells.

\*(2) Dr. Morse has lately discussed this subject in his paper on the "Adaptive Coloration of Mollusca," Proc. Boston Soc. of Nat. Hist., vol. xiv., April, 1871.

These naked sea-slugs are hermaphrodites, yet they pair together, as do land-snails, many of which have extremely pretty shells. It is conceivable that two hermaphrodites, attracted by each other's greater beauty, might unite and leave offspring which would inherit their parents' greater beauty. But with such lowly-organised creatures this is extremely improbable. Nor is it at all obvious how the offspring from the more beautiful pairs of hermaphrodites would have any advantage over the offspring of the less beautiful, so as to increase in number, unless indeed vigour and beauty generally

coincided. We have not here the case of a number of males becoming mature before the females, with the more beautiful males selected by the more vigorous females. If, indeed, brilliant colours were beneficial to a hermaphrodite animal in relation to its general habits of life, the more brightly-tinted individuals would succeed best and would increase in number; but this would be a case of natural and not of sexual selection.

Sub-kingdom of the VERMES; Class: ANNELIDA (or Sea-worms). - In this class, although the sexes, when separate, sometimes differ from each other in characters of such importance that they have been placed under distinct genera or even families, yet the differences do not seem of the kind which can be safely attributed to sexual selection. These animals are often beautifully coloured, but as the sexes do not differ in this respect, we are but little concerned with them. Even the nemertians, though so lowly organised, "vie in beauty and variety of colouring with any other group in the invertebrate series"; yet Dr. McIntosh\* cannot discover that these colours are of any service. The sedentary annelids become duller-coloured, according to M. Quatrefages,\*<sup>(2)</sup> after the period of reproduction; and this I presume may be attributed to their less vigorous condition at that time. All these worm-like animals apparently stand too low in the scale for the individuals of either sex to exert any choice in selecting a partner, or for the individuals of the same sex to struggle together in rivalry.

\* See his beautiful monograph on British Annelids, part i., 1873, p. 3.

\*<sup>(2)</sup> See M. Perrier: "L'Origine de l'Homme d'après Darwin," *Revue Scientifique*, Feb., 1873, p. 866.

Sub-kingdom of the ARTHROPODA; Class: CRUSTACEA. - In this great class we first meet with undoubted secondary sexual characters, often developed in a remarkable manner. Unfortunately the habits of crustaceans are very imperfectly known, and we cannot explain the uses of many structures peculiar to one sex. With the lower parasitic species the males are of small size, and they alone are furnished with perfect swimming-legs, antennae and sense-organs; the females being destitute of these organs, with their bodies often consisting of a mere distorted mass. But these extraordinary differences between the two sexes are no doubt related to their widely different habits of life, and consequently do not concern us. In various crustaceans, belonging to distinct families, the anterior antennae are furnished with peculiar thread-like bodies, which are believed to act as smelling-organs, and these are much more numerous in the males than in the females. As the males, without any unusual development of their olfactory organs, would almost certainly be able sooner or later to find the females, the increased number of the smelling-threads has probably been acquired through sexual selection, by the better provided males having been the more successful in finding partners and in producing offspring. Fritz Muller has described a remarkable dimorphic species of Tanais, in which the male is represented by two distinct forms, which never graduate into each other. In the one form the male is furnished with more numerous smelling-threads, and in the other form with more powerful and more elongated chelae or pincers, which serve to hold the female. Fritz Muller suggests that these differences between the two male forms of the same species may have originated in certain individuals having varied in the number of the smelling-threads, whilst other individuals varied in the shape and size of their chelae; so that of the former, those which were best able to find the female, and of the latter, those which were best able to hold her, have left the greatest number of progeny to inherit their respective advantages.\*

\* Facts and arguments for Darwin, English transl., 1869, p. 20.

See the previous section on the olfactory threads. Sars has described a somewhat analogous case (as quoted in *Nature*, 1870, p. 455) in a Norwegian crustacean, the *Pontoporeia affinis*.

In some of the lower crustaceans, the right anterior antenna of the male differs greatly in structure from the left, the latter resembling in its simple tapering joints the antennae of the female. In the male the modified antenna is either swollen in the middle or angularly bent, or converted (see fig. 4) into an elegant, and sometimes wonderfully complex, prehensile organ.\* It serves, as I hear from Sir J. Lubbock, to hold the female, and for this same purpose one of the two posterior legs (b) on the same side of the body is converted into a forceps. In another family the inferior or posterior antennae are "curiously zigzagged" in the males alone.

\* See Sir J. Lubbock in *Annals and Mag. of Nat. Hist.*, vol. xi., 1853, pls. i. and x.; and vol. xii. (1853), pl. vii. See also Lubbock in *Transactions, Entomological Society*, vol. iv., new series, 1856-1858, p. 8. With respect to the zigzagged antennae mentioned below, see Fritz Muller, *Facts and Arguments for Darwin*, 1869, p. 40, footnote.

In the higher crustaceans the anterior legs are developed into chelae or pincers; and these are generally larger in the male than in the female, - so much so that the market value of the male edible crab (*Cancer pagurus*), according to Mr. C. Spence Bate, is five times as great as that of the female. In many species the chelae are of unequal size on the opposite side of the body, the right-hand one being, as I am informed by Mr. Bate, generally, though not invariably, the largest. This inequality is also often much greater in the male than in the female. The two chelae of the male often differ in structure (see figs. 5, 6, and 7), the smaller one resembling that of the female. What advantage is gained by their inequality in size on the opposite sides of the body, and by the inequality being much greater in the male than in the female; and why, when they are of equal size, both are often much larger in the male than in the female, is not known. As I hear from Mr. Bate, the chelae are sometimes of such length and size that they cannot possibly be used for carrying food to the mouth. In the males of certain fresh-water prawns (*Palaemon*) the right leg is actually longer than the whole body.\* The great size of the one leg with its chelae may aid the male in fighting with his rivals; but this will not account for their inequality in the female on the opposite sides of the body. In *Gelasimus*, according to a statement quoted by Milne Edwards,\*(2) the male and the female live in the same burrow, and this shews that they pair; the male closes the mouth of the burrow with one of its chelae, which is enormously developed; so that here it indirectly serves as a means of defence. Their main use, however, is probably to seize and to secure the female, and this in some instances, as with *Gammarus*, is known to be the case. The male of the hermit or soldier crab (*Pagurus*) for weeks together, carries about the shell inhabited by the female.\*(3) The sexes, however, of the common shore-crab (*Carcinus manas*), as Mr. Bate informs me, unite directly after the female has moulted her hard shell, when she is so soft that she would be injured if seized by the strong pincers of the male; but as she is caught and carried about by the male before moulting, she could then be seized with impunity.

\* See a paper by Mr. C. Spence Bate, with figures, in *Proceedings, Zoological Society*, 1868, p. 363; and on the nomenclature of the genus, *ibid.*, p. 585. I am greatly indebted to Mr. Spence Bate for nearly all the above statements with respect to the chelae of the higher crustaceans.

\*(2) *Hist. Nat. des Crust.*, tom. ii., 1837, p. 50.

\*(3) Mr. C. Spence Bate, *British Association, Fourth Report on the*

Fritz Muller states that certain species of *Melita* are distinguished from all other amphipods by the females having "the coxal lemellae of the penultimate pair of feet produced into hook-like processes, of which the males lay hold with the hands of the first pair." The development of these hook-like processes has probably followed from those females which were the most securely held during the act of reproduction, having left the largest number of offspring. Another Brazilian amphipod (see *Orchestia darwinii*, fig. 8) presents a case of dimorphism, like that of *Tanais*; for there are two male forms, which differ in the structure of their chelae.\* As either chela would certainly suffice to hold the female, - for both are now used for this purpose, - the two male forms probably originated by some having varied in one manner and some in another; both forms having derived certain special, but nearly equal advantages, from their differently shaped organs.

\* Fritz Muller, Facts and Arguments for Darwin, 1869, pp. 25-28.

It is not known that male crustaceans fight together for the possession of the females, but it is probably the case; for with most animals when the male is larger than the female, he seems to owe his greater size to his ancestors having fought with other males during many generations. In most of the orders, especially in the highest or the *Brachyura*, the male is larger than the female; the parasitic genera, however, in which the sexes follow different habits of life, and most of the *Entomostraca* must be excepted. The chelae of many crustaceans are weapons well adapted for fighting. Thus when a devil-crab (*Portunus puber*) was seen by a son of Mr. Bate fighting with a *Carcinus maenas*, the latter was soon thrown on its back, and had every limb torn from its body. When several males of a Brazilian *Gelasimus*, a species furnished with immense pincers, were placed together in a glass vessel by Fritz Muller, they mutilated and killed one another. Mr. Bate put a large male *Carcinus maenas* into a pan of water, inhabited by a female which was paired with a smaller male; but the latter was soon dispossessed. Mr. Bate adds, "if they fought, the victory was a bloodless one, for I saw no wounds." This same naturalist separated a male sand-skipper (so common on our sea-shores), *Gammarus marinus*, from its female, both of whom were imprisoned in the same vessel with many individuals of the same species. The female, when thus divorced, soon joined the others. After a time the male was put again into the same vessel; and he then, after swimming about for a time, dashed into the crowd, and without any fighting at once took away his wife. This fact shews that in the *Amphipoda*, an order low in the scale, the males and females recognise each other, and are mutually attached.

The mental powers of the *Crustacea* are probably higher than at first sight appears probable. Any one who tries to catch one of the shore-crabs, so common on tropical coasts, will perceive how wary and alert they are. There is a large crab (*Birgus latro*), found on coral islands, which makes a thick bed of the picked fibres of the cocoa-nut, at the bottom of a deep burrow. It feeds on the fallen fruit of this tree by tearing off the husk, fibre by fibre; and it always begins at that end where the three eye-like depressions are situated. It then breaks through one of these eyes by hammering with its heavy front pincers, and turning round, extracts the albuminous core with its narrow posterior pincers. But these actions are probably instinctive, so that they would be performed as well by a young animal as by an old one. The following case, however, can hardly be so considered: a trustworthy naturalist, Mr. Gardner,\* whilst watching a shore-crab (*Gelasimus*) making its burrow, threw some shells towards the hole. One rolled in, and three other shells remained within a few inches of the mouth. In about five minutes the crab brought out the shell which had fallen in, and carried it away to a

distance of a foot; it then saw the three other shells lying near, and evidently thinking that they might likewise roll in, carried them to the spot where it had laid the first. It would, I think, be difficult to distinguish this act from one performed by man by the aid of reason.

\* Travels in the Interior of Brazil, 1846, p. 111. I have given, in my Journal of Researches, p. 463, an account of the habits of the *Birgus*.

Mr. Bate does not know of any well-marked case of difference of colour in the two sexes of our British crustaceans, in which respect the sexes of the higher animals so often differ. In some cases, however, the males and females differ slightly in tint, but Mr. Bate thinks not more than may be accounted for by their different habits of life, such as by the male wandering more about, and being thus more exposed to the light. Dr. Power tried to distinguish by colour the sexes of the several species which inhabit Mauritius, but failed, except with one species of *Squilla*, probably *S. stylifera*, the male of which is described as being "of a beautiful bluish-green," with some of the appendages cherry-red, whilst the female is clouded with brown and grey, "with the red about her much less vivid than in the male."\* In this case, we may suspect the agency of sexual selection. From M. Bert's observations on *Daphnia*, when placed in a vessel illuminated by a prism, we have reason to believe that even the lowest crustaceans can distinguish colours. With *Saphirina* (an oceanic genus of Entomostraca), the males are furnished with minute shields or cell-like bodies, which exhibit beautiful changing colours; these are absent in the females, and in both sexes of one species.\*(2) It would, however, be extremely rash to conclude that these curious organs serve to attract the females. I am informed by Fritz Muller, that in the female of a Brazilian species of *Gelasimus*, the whole body is of a nearly uniform greyish-brown. In the male the posterior part of the cephalo-thorax is pure white, with the anterior part of a rich green, shading into dark brown; and it is remarkable that these colours are liable to change in the course of a few minutes- the white becoming dirty grey or even black, the green "losing much of its brilliancy." It deserves especial notice that the males do not acquire their bright colours until they become mature. They appear to be much more numerous than the females; they differ also in the larger size of their chelae. In some species of the genus, probably in all, the sexes pair and inhabit the same burrow. They are also, as we have seen, highly intelligent animals. From these various considerations it seems probable that the male in this species has become gaily ornamented in order to attract or excite the female.

\* Mr. Ch. Fraser, in Proc. Zoolog. Soc., 1869, p. 3.

\*(2) Claus, Die freilebenden Copepoden, 1863, s. 35.

It has just been stated that the male *Gelasimus* does not acquire his conspicuous colours until mature and nearly ready to breed. This seems a general rule in the whole class in respect to the many remarkable structural differences between the sexes. We shall hereafter find the same law prevailing throughout the great sub-kingdom of the Vertebrata; and in all cases it is eminently distinctive of characters which have been acquired through sexual selection. Fritz Muller\* gives some striking instances of this law; thus the male sand-hopper (*Orchestia*) does not, until nearly full grown, acquire his large claspers, which are very differently constructed from those of the female; whilst young, his claspers resemble those of the female.

\* Facts and Arguments, &c., p. 79.

I am indebted to Mr. Bate for Dr. Power's statement.

Class: ARACHNIDA.- The sexes do not generally differ much in colour, but the males are often darker than the females, as may be seen in Mr. Blackwall's magnificent work.\* In some species, however, the difference is conspicuous: thus the female of *Sparassus smaragdulus* is dullish green, whilst the adult male has the abdomen of a fine yellow, with three longitudinal stripes of rich red. In certain species of *Thomisus* the sexes closely resemble each other, in others they differ much; and analogous cases occur in many other genera. It is often difficult to say which of the two sexes departs most from the ordinary coloration of the genus to which the species belong; but Mr. Blackwall thinks that, as a general rule, it is the male; and Canestrini\*(2) remarks that in certain genera the males can be specifically distinguished with ease, but the females with great difficulty. I am informed by Mr. Blackwall that the sexes whilst young usually resemble each other; and both often undergo great changes in colour during their successive moults, before arriving at maturity. In other cases the male alone appears to change colour. Thus the male of the above bright-coloured *Sparassus* at first resembles the female, and acquires his peculiar tints only when nearly adult. Spiders are possessed of acute senses, and exhibit much intelligence; as is well known, the females often shew the strongest affection for their eggs, which they carry about enveloped in a silken web. The males search eagerly for the females, and have been seen by Canestrini and others to fight for possession of them. This same author says that the union of the two sexes has been observed in about twenty species; and he asserts positively that the female rejects some of the males who court her, threatens them with open mandibles, and at last after long hesitation accepts the chosen one. From these several considerations, we may admit with some confidence that the well-marked differences in colour between the sexes of certain species are the results of sexual selection; though we have not here the best kind of evidence, - the display by the male of his ornaments. From the extreme variability of colour in the male of some species, for instance of *Theridion lineatum*, it would appear that these sexual characters of the males have not as yet become well fixed. Canestrini draws the same conclusion from the fact that the males of certain species present two forms, differing from each other in the size and length of their jaws; and this reminds us of the above cases of dimorphic crustaceans.

\* A History of the Spiders of Great Britain, 1861-64. For the following facts, see pp. 77, 88, 102.

\*(2) This author has recently published a valuable essay on the "Caratteri sessuali secondarii degli Arachnidi," in the *Atti della Soc. Veneto-Trentina di Sc. Nat. Padova*, vol. i., fasc. 3, 1873.

The male is generally much smaller than the female, sometimes to an extraordinary degree,\* and he is forced to be extremely cautious in making his advances, as the female often carries her coyness to a dangerous pitch. De Greer saw a male that "in the midst of his preparatory caresses was seized by the object of his attentions, enveloped by her in a web and then devoured, a sight which, as he adds, filled him with horror and indignation."\*(2) The Rev. O. P. Cambridge\*(3) accounts in the following manner for the extreme smallness of the male in the genus *Nephila*. "M. Vinson gives a graphic account of the agile way in which the diminutive male escapes from the ferocity of the female, by gliding about and playing hide and seek over her body and along her gigantic limbs: in such a pursuit it is evident that the chances of escape would be in favour of the smallest males, whilst the larger ones would fall early victims; thus gradually a diminutive race of males would be selected, until at last they would dwindle to the smallest possible size compatible with the exercise of their generative functions,- in fact, probably to the size we now see them, i. e., so small as to be a sort of parasite upon the female, and either beneath her notice, or too



agile and too small for her to catch without great difficulty."

\* Aug. Vinson (*Araneides des Iles de la Reunion*, pl. vi., figs. 1 and 2) gives a good instance of the small size of the male in *Epeira nigra*. In this species, as I may add, the male is testaceous and the female black with legs banded with red. Other even more striking cases of inequality in size between the sexes have been recorded (*Quarterly Journal of Science*, July, 1868, p. 429); but I have not seen the original accounts.

\*(2) Kirby and Spence, *Introduction to Entomology*, vol. i., 1818, p. 280.

\*(3) *Proceedings, Zoological Society*, 1871, p. 621.

Westring has made the interesting discovery that the males of several species of *Theridion*\* have the power of making a stridulating sound, whilst the females are mute. The apparatus consists of a serrated ridge at the base of the abdomen, against which the hard hinder part of the thorax is rubbed; and of this structure not a trace can be detected in the females. It deserves notice that several writers, including the well-known arachnologist Walckenaer, have declared that spiders are attracted by music.\*(2) From the analogy of the Orthoptera and Homoptera, to be described in the next chapter, we may feel almost sure that the stridulation serves, as Westring also believes, to call or to excite the female; and this is the first case known to me in the ascending scale of the animal kingdom of sounds emitted for this purpose.\*(3)

\* *Theridion* (*Asagena*, Sund.) *serratipes*, *4-punctatum* et *guttatum*; see Westring, in Kroyer, *Naturhist. Tidskrift*, vol. iv., 1842-1843, p. 349; and vol. ii., 1846-1849, p. 342. See, also, for other species, *Araneae Suecicae*, p. 184.

\*(2) Dr. H. H. van Zouteveen, in his Dutch translation of this work (vol. i., p. 444), has collected several cases.

\*(3) Hilgendorf, however, has lately called attention to an analogous structure in some of the higher crustaceans, which seems adapted to produce sound; see *Zoological Record*, 1869, p. 603.

Class: MYRIAPODA. - In neither of the two orders in this class, the millipedes and centipedes, can I find any well-marked instances of such sexual differences as more particularly concern us. In *Glomeris limbata*, however, and perhaps in some few other species, the males differ slightly in colour from the females; but this *Glomeris* is a highly variable species. In the males of the Diplopoda, the legs belonging either to one of the anterior or of the posterior segments of the body are modified into prehensile hooks which serve to secure the female. In some species of *Iulus* the tarsi of the male are furnished with membranous suckers for the same purpose. As we shall see when we treat of insects, it is a much more unusual circumstance, that it is the female in *Lithobius*, which is furnished with prehensile appendages at the extremity of her body for holding the male.\*

\* Walckenaer et P. Gervais, *Hist. Nat. des Insectes: Apteres*, tom. iv., 1847, pp. 17, 19, 68.