

THE
INTELLECTUAL OBSERVER

REVIEW OF NATURAL HISTORY
MICROSCOPIC RESEARCH
AND
RECREATIVE SCIENCE

VOLUME XII.

ILLUSTRATED WITH PLATES IN COLOURS AND TINTS, AND NUMEROUS
ENGRAVINGS ON WOOD



LONDON
GROOMBRIDGE AND SONS
PATERNOSTER ROW.

MDCCCLXVIII.

excretions, with the exception of the milt of the male and the roe of the female being of an exhausting kind.

The conclusion, then, at which I think we may safely arrive with regard to the food of the salmon is—that it feeds freely in the sea, and chiefly on other kinds of fish, such as sand-lanices, herrings, and other *clupeidæ*, though other animals, such as shrimps, and various crustacea occasionally form part of its diet; that during its sojourn in the sea the salmon lays up a store of adipose matter; that it very seldom feeds during its abode in the fresh-water rivers, but lives on the supplies of its own internal fat; that though for some time the flesh does not perceptibly deteriorate, it is rendered poorer in quality towards the end of its sojourn in the fresh water, both from the exhaustion of its own supplies of fat and from the effects of spawning; that it rapidly improves when it has reached the salt water, when it again lays up a fresh supply of adipose matter, which will support it during its sojourn in the rivers.

A SYNOPSIS OF THE RECENT BRITISH OSTRACODA.

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(With Two Plates.)

OF the various orders included in the great tribe Entomostraca, there is, perhaps, not one more generally interesting than that of which we propose to treat in the present paper. When we consider the great abundance and wide dispersion of the Ostracoda through the fresh waters and seas of our own period, and the countless myriads in which the shells of ante-diluvian species have come down to us, embedded in strata of varied character and age—for example, Silurian, Liassic, Carboniferous, Permian, Tertiary, and Post-tertiary—it will be evident that the geologist and palæontologist must, to a very large extent, share their interest in this group with the student of recent zoology and physiology. It will be seen also that any light which may be thrown upon the structure and habits of living forms must likewise be of great importance to the student of extinct species, as tending to exhibit more clearly their natural affinities, and to establish sounder principles of classification than can be attained by the study merely of the external covering of the animal, which only is left to us in the case of fossil examples. The prodigious numbers in which the fossilized carapaces of these creatures sometimes occur, is

almost incomprehensible, some strata of certain rock formations seeming to be almost entirely composed of them. Amongst the recent species I know of no case analogous to this, except that of the dwellers in salt marshes and estuary mud; and I have no doubt that, were the mud-banks of our tidal rivers, and the swamps adjacent, suddenly petrified, we should, in many cases, find that the resulting stratified rock would exhibit as wonderful a concourse of once-living crustacean shells, as those which have just been spoken of. Mr. W. K. Parker has indeed conjectured, from a study of their fossil Rhizopoda, that the post-tertiary clays of the district round Peterborough constitute a littoral, brackish water-deposit; and it is remarkable that the Foraminifera there found, agree, to a very large extent, with those which I have myself taken in the salt marshes of our north-eastern coast. In strata much older than the post-tertiary, one would not, of course, expect to find species exactly identical with those now living. In washings of these clays, however, with which Mr. Parker has kindly supplied me, I have not been able to detect any shells of Ostracoda; it is, indeed, noticeable, that fossiliferous strata which are rich in Foraminifera are mostly poor in Ostracoda, and *vice versa*. Such, on consideration, one would naturally expect to be often the case. In all the salt marshes which I have had the opportunity of examining, living Ostracoda have been very abundant. If the net be passed carefully along the surface of the soft mud, so as to take up a thin layer, and the mass thus obtained be then washed through the net sufficiently to clear it of the fine ooze which will be found to constitute the greater part of its bulk, the residue will mostly consist of Ostracoda, living and dead, grains of sand, fragments of decaying vegetable matter, and very probably a good many living Foraminifera. This will mostly be the result wherever the water is brackish, and deposits a good deal of slimy mud, but in fresh water, or at the mouths of rivers, where the stream is clear and rapid, and does not produce much fine deposit, the Ostracoda, and other Microzoa, will be found much less plentifully. My belief is, therefore, that those strata which exhibit such very abundant and closely-packed remains of the smaller Cypridæ and Cytheridæ have most likely been formed in shallow, brackish lagoons, or at the mouths and deltas of rivers. The species of Ostracoda which I have found in these situations are, *Cytheridea torosa* (Jones), *Cythere pellucida* Baird, and *Loxococoncha elliptica* Brady; while in water, a little further from the saline influence, but still slightly partaking of it, it is not uncommon to meet with *Cypris salina* Brady, and *Cypridopsis aculeata* (Lilljeborg), as well as Entomostraca belonging to other orders. Some

crustacea of larger type are also commonly met with in brackish waters,* e.g., *Corophium longicorne*, *Palæmon varians*, *Mysis vulgaris*, the common shrimp, etc.; but these, not having a hard, durable, calcareous investment, are not found in the fossil state. The Foraminifera which I have usually found in company with the Ostracoda above mentioned are, *Polystomella striatopunctata*, *Quinqueloculina agglutinans*, *Trochammina inflata*, *Rotalia Beccarii*, and *Nonionina depressula*; the relative abundance of these forms varying with the locality.† The marshes of the Northumberland and Durham coasts are the only ones which have yet been carefully examined, and it is quite probable that other districts might yield different species.

By far the greater number of Ostracoda at present known have been described from fossil specimens, and the generic and specific characters have, of course, been taken almost exclusively from the external characters of the shell, the chief of these being, its general form and contour, mode of hingement, arrangement of lucid (or muscle) spots and style of surface ornament. The general structure of the animals themselves has indeed been known sufficiently to form good grounds of separation between some well-defined families, such as Cypridæ, Cytheridæ, and Cypridinidæ, but the more minute anatomy indicative of generic and specific differences has, until recently, been very little understood or investigated. The family Cytheridæ, for instance, has been considered by most authors as consisting of some three or four genera (or sub-genera of Cythere), separated from each other by shell-characters merely, and the family Cypridæ of two genera. But when we consider that, of the one hundred and thirty-seven species of Ostracoda now known as living in the waters of Great Britain, all except ten belong to these two families, and that amongst fossil species the disproportion is even greater, it is evident that, amongst so vast a number of species, many important differences of internal structure must exist, and that these stood in need only of careful investigation in order to form good grounds of generic subdivision. Accordingly, we find that much has of late years been done in this direction, more especially by Zenker and Fischer in Germany and Russia, and by Lilljeborg and G. O. Sars in Scandinavia. The researches

* See my paper on "Salt Marshes and their Inhabitants," in INTELLECTUAL OBSERVER, Vol. v. p. 26.

† Any readers of the INTELLECTUAL OBSERVER living in the neighbourhood of salt marshes or muddy estuaries would materially contribute to the knowledge of a very important and interesting branch of natural history by collecting the Microzoa in the manner above described. The best material for collecting-nets is "crinoline;" the things captured may be preserved, either by drying, or by immersion in dilute spirit. I should myself be very glad of the opportunity of examining any such collections, and would with pleasure name the specimens obtained.

of the last-named author, embodied in his recent work on the marine Ostracoda of Norway,* are of particular interest to English naturalists, seeing that the marine faunas of the two countries exhibit a very close affinity. He has succeeded, after a most careful and painstaking investigation of the Norwegian species, in accurately ascertaining the minute structure of animals belonging to all the described fossil genera (excepting only, as he says, *Cytheridea*, which, however, I regard as belonging to the same genus as the forms he describes under the name *Cyprideis*), and has also established a large number of new species and genera. After a similar survey of the British marine and fresh-water species (in which I have received most valuable assistance from many collectors and naturalists whom I need not here stop to name), I have myself added many species to the list, and have found it needful also to propose some few new genera. A brief analysis of these I propose now to lay before the reader; but before doing so, it will be desirable to describe succinctly the general type of structure of the Ostracoda.

Each member of the class Crustacea is considered, typically, to be divisible into twenty-one annular segments, or somites, seven of which belong to the head (*cephalon*), seven to the thorax (*pereion*), and seven to the abdomen (*pleon*). But it is only in very few cases, and these amongst the more highly organized members of the class, that these segments, or their rudiments, are discernible. In most cases some of the segments are fused together, so that their real nature is to be recognized only by the presence of certain limbs or appendages which indicate their existence. Thus, under the hard, calcareous carapace, or shield, which protects the head and back of the lobster, we find gathered all the cephalic and thoracic members of the animal, and so we learn that the great dorsal buckler consists, in fact, of all the cephalic and thoracic segments of the body, cemented into one strong protecting plate. This principle, infinitely modified, runs through the whole class; but we also find that, in addition to the coalescence of various segments, other segments are often entirely absent, their presence not even indicated by the existence of any limbs or appendages. So that it is only by the careful study and comparison of the whole group that the real nature and homologies of any particular organ can be made out. The appendages of the twenty-one segments of the typical Crustacea may be tabulated as follows:—1, Eyes; 2, 3, First and second antennæ; 4, Mandibles; 5, 6, Two pairs of jaws; 7, 8, 9, Foot-jaws; 10—14, Ambulatory legs; 15—20, False or abdominal feet; 21, Tail-piece or post-abdomen. In the

* "Oversigt af Norges Marine Ostracoder" af G. O. Sars, 1865.
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Ostracoda the segments of the body are almost entirely obsolete, the body itself being soft, and entirely covered by two usually hard and calcareous, but sometimes thin and horny, valves.

The family Cypridæ, which includes almost all the freshwater, and a few of the marine Ostracoda, may be taken as the basis of our description. The various organs will be better understood by reference to the plates, where they are figured in detail.

The first limb, or *upper antenna* (Fig. 1, *b*), here consists of a tapering seven-jointed curved appendage, which bears at its apex a dense bundle of long plumose setæ. The second, or *lower antenna* (Fig. 1, *c*), is usually stouter, four-jointed, strongly bent or "geniculate," clawed at the extremity, and adapted for walking, though in many cases it is also provided with a lash of setæ, which adapts it likewise for swimming. The *mandible* (Fig. 1, *d*) consists of an elongated triangular body, the base of which is directed downwards, and is divided into numerous teeth. From one side springs a four-jointed palp (Fig. 1, *f*), whose basal joint bears one of the branchial organs (Fig. 1, *e*). Of the two pairs of jaws, the *first* (*g*) is the larger, and is divided into four segments; to it is attached a large branchial plate (*h*), the principal breathing organ of the animal. The *second* pair (*i*) is small, and has a non-articulate palp, which, in the male, is often modified into a prehensile organ. In some genera this pair of jaws bears also a small branchial plate. There are *two pairs of feet*, the first (*j*) clawed at the extremity, and adapted for walking; the last (*k*) slender, flexuous, and always tucked up within the shell. The *post-abdomen* (*m*) consists of two flattened elongated rami, which are very movable, strongly clawed at the extremity, and lie side by side, mostly within the shell. There are sometimes two eyes (*a*), but these are mostly confluent. The *ovaries* (*o*) lie round the body of the animal, directly beneath the shell. The *copulative organs* of the male are of very curious and complex structure, and have mostly attached to them a *mucous gland* (Fig. 4), consisting of a double central cylinder, and several whorls of radiating filaments. The shell is thin and fragile, and mostly somewhat reniform or ovate in shape, devoid of sculpture, except sometimes a fine impressed punctation; occasionally densely hispid or even spinous.

We shall now briefly point out the characters in which the other families chiefly differ from the Cypridæ.

CYTHERIDÆ.—This family includes by far the greater number of the marine Ostracoda, and some few species are inhabitants of fresh water. Both pairs of antennæ (Fig. 2, *b*, *c*) are en-

tirely destitute of the filamentous brushes which give swimming power to many of the members of the preceding family; but the upper antennæ (*b*) are beset with strong marginal spines or setæ; and the lower (*c*) are provided with a single long tubular flagellum, which communicates with a poison-gland (*v*), situated in the anterior portion of the body of the animal. There is only one pair of jaws (*g*), similar to the first pair of the Cypridæ. Three pairs of feet (*r*, *s*, *t*), all of which protrude from the shell, are very similar in form, though increasing in length from the first to the last, and are adapted for walking. The post-abdomen is composed of two very small and inconspicuous lobes (*m*). The ovaries are not produced between the two valves. The male copulative organs are exceedingly large, and of complex structure, and are not provided with a "mucous gland." The shell is mostly more or less quadrangular in outline, but sometimes ovate or subtriangular; very variable both in structure and in external ornamentation.

CYPRIDINIDÆ.—The antennæ are here exceedingly large and muscular, the upper pair (Fig. 10, *b*) often bearing very long and slender terminal setæ, as well as a densely-tufted auditory seta. The lower (*c*) is especially powerful, composed of an excessively large and muscular basal joint, to which is attached a nine-jointed, branch, bearing numerous plumose setæ, which constitute it a powerful swimming apparatus. The mandible proper is rudimentary, but its palp (*f*) is developed into a large prehensile limb. Three pairs of maxillæ, of very variable structure (*g*, *h*, *i*). One pair of feet, of very peculiar structure (*h*), forming a long, flexuous, annulated, vermiform process, bearing several toothed spines at its extremity and evidently homologous with the second pair of feet of the Cypridæ. The post-abdomen is composed of two large closely-appressed plates (*m*), which are powerfully clawed along the posterior margin. Eyes two (*a*), pedunculated. Shell subovate or subspherical, having a distinct beak, with a large underlying notch in front, through which the antennæ are protruded whilst swimming.

Some of the members of this family have very slight swimming power, and live chiefly amongst mud; others are very agile swimmers, and are often taken in the towing-net—more especially at night—near the surface of the sea. They seem, indeed, to contribute very materially to the production of the wonderful phosphorescence of the tropical seas.

CONCHOECIADÆ.—Closely allied to the preceding family. The upper antennæ are, however, in the female, very small; the lower antennæ almost exactly as in Cypridina. Mandibles distinct, narrow, and toothed; palp large and pediform, terminating in long claws. Two pairs of jaws. Two pairs of feet,

the anterior long, five-jointed, and dissimilar in the male and female; posterior very small and rudimentary. Post-abdomen consisting of two short, clawed laminae. Shell excessively thin and flexible, almost membranaceous; in general shape approaching that of the Cypridinidæ.

POLYCOPEIDÆ.—Both pairs of antennæ natatory: the upper simple; the lower two-branched. Mandibular palp small, not pediform. Two pairs of feet: the anterior natatory; the posterior branchial. Abdomen terminating in two short unguiferous laminae. Eyes and heart wanting. Intestine forming a simple sac. Shell thin, calcareous, not notched.

CYTHERELLIDÆ.—Antennæ very large; the upper multi-articulate and geniculate; the lower broad, two-branched, much like the feet of the Copepoda. Mandibles very small, bearing a large setose palp. Three pairs of legs, which are scarcely pediform: the anterior two branchial; the posterior rudimentary. Abdomen terminating in two very small and narrow spiniferous laminae. Ova and young borne under the shell of the female. Valves very unequal in size, not notched; structure very dense, hinge formed by a simple groove.

It is impossible, in the necessarily restricted limits of a magazine article, to give a detailed account of the specific characters of all the British Ostracoda. I propose, however, to indicate briefly the more important characters of the different genera (a thing which has not yet been done with reference to anatomical characters in this country), giving under each genus a list of the British species belonging to it, and appending such remarks concerning them as may appear likely to be of general interest, or helpful to those seeking for special information respecting this interesting group of Microzoa.

Family—CYPRIDÆ.

Genus **CYPRIS**, Müller.—Upper and lower antennæ both provided with a tuft of plumose filaments, the lower pediform. Both pairs of jaws bearing branchial appendages. Second pair of jaws in the male prehensile; in the female consisting of a short lobe, a palp which terminates in three setæ, and a small branchial plate with six radiating respiratory setæ. Post-abdominal rami long and slender, having two terminal curved claws and a small seta. Males provided with a "mucous gland," composed of a double cylinder beset with radiating filaments. Shell mostly subreniform or ovate, and of no great thickness. Inhabits fresh water.

BRITISH SPECIES.—*C. fusca*, Straus; *incongruens*, Ramdohr;

virens (Jurine), *obliqua*, Brady;* *elliptica*, Baird; *punctillata*, Norman; *bispinosa*, Lucas; *gibbosa*, Baird; *tessellata*, Fischer; *clavata*, Baird; *salina*, Brady; *gibba*, Ramdohr; *trigonella*, Brady; *reptans* (Baird); *serrata* (Norman), *compressa*, Baird; *striolata*, Brady; *ovum* (Jurine), *lævis*, Müller; *cinerea*, Brady; *Joanna*, Baird.

Most of the species of the genus *Cypris*, being enabled to swim freely by means of the setose appendages of the antennæ, are active in their habits, and very abundant in ponds and small pieces of water, especially where there is much decomposing vegetable matter. They do not appear to be so numerous in large clear lakes, and from elevated mountain tarns they are frequently altogether absent. Some species, however, have their lower antennæ very sparingly armed with setæ, and those so short and few as to give little or no swimming power. Species possessing such characters (*C. reptans* and *serrata*) have been placed by authors in the genus *Candona*; but it seems best to restrict that genus, as will be presently mentioned. There is considerable diversity in the colour and external appearance of the Cyprides: some being perfectly smooth; others simply punctate or striated; others densely hairy; while one species (*tessellata*) is most beautifully reticulated with a pattern which has much the appearance, in fine examples, of silver filagree work. The prevailing colours are uniform shades of brown and green; but some species, as *salina* and *serrata*, are variegated with dark markings upon a light ground. Four of the species mentioned above (*elliptica*, *gibbosa*, *clavata*, *Joanna*) have not been found, or at any rate have not been recognized, since their publication by Dr. Baird; and one, the finest of all (*bispinosa*), is claimed as British only on account of its occurrence in the island of Guernsey. It was originally found in Algiers. Perhaps the most abnormal species is *C. gibba*—an animal which, though its antennæ seem well adapted for swimming, apparently never uses them for that purpose, but contents itself with an inactive life upon clayey bottoms, with which its colour closely assimilates. Its shell is much more dense than is usual in this genus, and may perhaps need more power to sustain it in the water than the antennæ are able to afford.

CYPRIDOPSIS, nov. gen.—Like *Cypris*, except that the post-abdominal rami (Fig. 3) are quite rudimentary, consisting of two slender, setiform processes, springing from a common base. Lives in fresh water.

C. vidua (Müller), *aculeata* (Lilljeborg), *villosa* (Jurine).—

* The species to which my own name is attached, are quoted chiefly from a "Monograph of the Recent British Ostracoda," read before the Linnean Society, and which will be published in the Transactions of that body.

All small species. The first-named is of common occurrence; colour whitish, marked with two broad and conspicuous transverse bands of black. The other two are somewhat rare; colour green. *C. aculeata* affects chiefly water that is slightly brackish, and in such situations is sometimes accompanied by *Cypris salina*. From the green colour of the animal, and the contents of the digestive canal, it would appear that it feeds upon the vegetation among which it is found, and not upon animal matter, as seems to be the case with most crustacea.

PARACYPRIS, G. O. Sars.—Upper antennæ seven-jointed, shortly setose; lower antennæ bearing, on the last joint but one, a pear-shaped, pedicillated hyaline vesicle. Second pair of jaws having a branchial appendage. Second pair of feet like the first in form and size, pediform, five-jointed. Post-abdominal rami large, clawed. Shell much higher in front than behind. Habitat, marine.

P. polita, G. O. Sars.—A very handsome species living in water of considerable depth, and apparently of rare occurrence in our seas, though ranging from the Channel Islands to Shetland and Norway. The remarkable vesicle attached to the lower antennæ is visible also in Pontocypris; its use is entirely unknown.

NOTODROMAS, Lilljeborg.—Antennæ like those of Cypris, upper seven, lower six-jointed. Second pair of jaws without a branchial appendage, pediform in the male. Post-abdominal rami long and rather slender. Mucous gland and copulative organs of the male very complex in structure. Shell of very different shape in the male and female. Inhabiting fresh water.

N. monachus (Müller).—A tolerably common species, often occurring in great abundance and at once recognizable by its peculiarly quadrate form, flattened ventral surface and deep black colour.

CANDONA, Baird.—Like Cypris, except that the lower antennæ possess no tuft of setæ and that the second pair of jaws is destitute of a branchial appendage. Inhabits fresh water.

C. albicans, Brady; *lactea*, Baird; *compressa* (Koch); *canadida* (Müller); *detecta* (Müller).—These animals are unable to swim, and are altogether sluggish in their movements, mostly living on the muddy bottoms of ponds and stagnant water. They are all whitish in colour, the shell surface polished, finely punctated, or (as in *C. compressa*) delicately reticulated.

PONTOCYPRIS, G. O. Sars.—Lower antenna bearing a vesicle, as in Paracypris. Mandible and first pair of jaws having a branchial appendage; second pair of jaws without branchia, palp large and subpediform, three-jointed, the last joint in the

female armed with two long claws. Last pair of feet four-jointed, flexuous, terminating in several long setæ, the margin of one of which (Fig. 5) is beautifully pectinated. Post-abdominal rami (Fig. 6) well developed. Shell thin, higher in front than behind, covered, more or less, with fine appressed hairs. Marine.

P. mytiloides (Norman); *acupunctata*, Brady; *trigonella*, G. O. Sars; *angusta*, Brady.—These animals, of which the first-named is by far the most common, seem to delight in a muddy bottom; their movements are far from active, and they have not much capacity for swimming. *P. mytiloides* often occurs pretty plentifully in the mud of sheltered, quiet bays, and I have found it very abundantly amongst the ooze from oyster-barrels.

BAIRDIA, M'Coy.—The anatomical structure of this genus is as yet very imperfectly known, but is most probably nearly similar to that of the following genus. It differs, however, in having the post-abdominal rami very large and well developed. The valves are very unequal in size, the left being much the larger and overlapping the right both on the dorsal and ventral surfaces; outline subrhomboidal.

B. inflata (Norman); *acanthigera*, Brady; *obtusata*, G. O. Sars; *complanata*, Brady.—The first-named species is very closely allied to *B. subdeltoidea*, a form first described from fossil specimens, but having a very wide range at the present day, extending over the Atlantic and Indian Oceans and into the Mediterranean. In the British seas its place is taken by *B. inflata*, which has not yet been observed in any other region. I possess specimens of *B. subdeltoidea* dredged off Guernsey, but these have every appearance of being fossilized.

MACROCYPRIS, nov. gen.—Antennæ short and robust, the upper seven-jointed and shortly setiferous, the lower five-jointed and armed with long apical claws. First pair of jaws having an unusually small, subovate, branchial plate; second pair destitute of any branchial appendage; palp, in the female, large and subpediform, in the male, very robust and clawed. First and second pairs of feet very different in structure, the first pediform and strongly clawed, the second entirely covered by the shell. Post-abdominal rami rudimentary. The male possessing a long and narrow mucous gland. Shell elongated, attenuated at the extremities, smooth and polished; right valve larger than the left and overlapping on the dorsal margin.

M. Minna (Baird).—This fine species is very rare in Britain, having been found only off the coast of Shetland, but in the Norwegian seas it appears to be more common. It is referred by Sars to the genus Bairdia, that author not having seen any

living specimens belonging to the typical form of *Bairdia*. I have myself found, however, that the animal (and also the shell) of *B. inflata*, which certainly belongs to M'Coy's genus, differs in some important respects from *M. Minna*; it therefore becomes necessary to propose another generic name for this species.

Family—CYTHEREIDÆ.

CYTHERE, Müller.—Upper antennæ robust, five or six-jointed, armed on the anterior margin with three long curved spines, mostly one on the third and two on the fourth joint; lower four-jointed; mandibular palp three or four-jointed, bearing in place of branchial plate, a tuft of from two to five setæ. Eyes, one or two. Valves unequal, mostly thick and strong; surface variously ornamented with simple papillæ, tubercles, fine impressed punctations, or even with prominent ridges and spines or deep fossæ. Outline, as seen from the side, mostly sub-reniform or quadrangular. Hinge joint formed by interlocking teeth, two on the right and one or two on the left valve, with sometimes an intervening bar and furrow. Marine.

C. lutea, Müller; *viridis*, Müller; *pellucida*, Baird; *badia*, Norman; *tenera*, Brady; *oblonga*, Brady; *rubida*, Brady; *albomaculata*, Baird; *convexa*, Baird; *cuneiformis*, Brady; *limicola* (Norman); *globulifera*, Brady; *tuberculata* (G. O. Sars); *concinna*, Jones; *angulata* (G. O. Sars); *dubia*, Brady; *Finmarchica* (G. O. Sars); *villosa* (G. O. Sars); *Jeffreysii*, Brady; *laticarina*, Brady; *marginata*, Norman; *quadridentata*, Baird; *emaciata*, Brady; *mirabilis*, M.S.; *mucronata* (G. O. Sars); *Dunelmensis* (Norman); *Whiteii* (Baird); *antiquata* (Baird); *Jonesii* (Baird); *acerosa*, Brady; *semipunctata*, Brady.

—The thirty-one species here included under the genus *Cythere* are distributed by G. O. Sars and other authors between the two genera *Cythere* and *Cythereis*. Considered with reference to mere shell-characters no tenable line of separation can be found, but Sars supposed that he had discovered, in some minute but constant differences of animal structure, peculiarities which sufficed to place the generic distinction on a satisfactory basis. These characters were chiefly that in the restricted genus *Cythere* the flagellum of the lower antenna was equally long in both male and female; the mandibular palp three-jointed, and armed with simple curved setæ; while in *Cythereis* the flagellum of the female was very much shorter than in the male, the mandibular palp four-jointed and bearing three stout curved and pectinated setæ. These distinctions, though perhaps of no great importance, might have been allowed to form sufficient ground for the division of a large and somewhat incoherent genus,





but it happens that some species which are common enough in the British seas, though unknown to Sars when his memoir was written, are exactly intermediate in character, presenting different combinations of those peculiarities which were relied on to separate *Cythere* from *Cythereis*. It is therefore necessary either to constitute two or three new genera for the reception of these aberrant forms, or to give a more extended signification to the original genus, so as to include all under the one term *Cythere*. The latter is the course which I have adopted. The intermediate species here referred to are *C. albomaculata*, *convexa*, and *rubida*. *C. convexa* exhibits a remarkable approach to the genus *Bairdia* in general outline, the two valves being very unequal and decidedly beaked behind. In all essential points, however, it is a true *Cythere*. This genus includes a very large proportion of the fossil species; its preponderance appears, indeed, to have been greater during the earlier periods of the earth's history than now, though possibly this may partly arise from the great thickness and durability of the shells of many species, and especially of many of the fossil forms which have thus been preserved, while other more fragile species may have been destroyed.

The *Cytheres* have no power of swimming, and are met with abundantly both amongst the fuci of the littoral zone and amongst the mud and sand of the deep-sea bed. A muslin or crinoline net used amongst the rock-pools of any part of our coast cannot fail in the summer months to capture numbers of them. In these situations *C. albomaculata*, *lutea*, *viridis*, and *villosa* are perhaps the commonest; while beyond the littoral zone we most frequently meet with *pellucida*, *tuberculata*, *lutea*, etc. The forms here named *acerosa* and *semipunctata* seem to be very rare. Their anatomy is not at all known, but their external peculiarities lead to the belief that they may constitute the types of new genera.

LIMNOCYHERE, nov. gen.—Animal like *Cythere*, except that the upper antennæ (Fig. 7) are armed with short setæ instead of spines. They are five-jointed, slender, the antepenultimate joint excessively short, terminal joint much elongated. Shell rather thin, irregularly tuberculate or spinous. Inhabits fresh water.

L. inopinata (Baird); *monstrifica* (Norman).—I have not yet been able completely to examine the structure of these animals, but the conformation of the upper antennæ seems at once to separate them from the foregoing genus. They are very minute, and from their mode of life on clayey bottoms or amongst mud, are not easy of detection. Though hitherto noticed in but few localities, they are probably more common than that circumstance might lead one to suppose.

CYTHERIDEA, Bosquet.—Upper antennæ (Fig. 8), robust, five-jointed and strongly spinous, the last joint narrow and elongated; lower antennæ four-jointed, flagellum long and slender. Right foot of the first and second pairs in the male different from the rest, that of the first pair very strong and prehensile, of the second very feeble, the apical portion rudimentary and not clawed. Shell subtriangular, highest in front, thick; surface smooth, closely pitted, or concentrically rugose. Hinge-joint formed by two crenulated elevations of the right valve, which are received into corresponding depressions of the left. Habitat, mostly marine.

C. elongata, Brady; *papillosa*, Bosquet; *Zetlandica*, Brady; (?) *subflavescens*, Brady; *punctillata*, Brady; *torosa*, (Jones); *lacustris* (G. O. Sars); *dentata*, G. O. Sars.

The genus Cyprideis, Jones, is here united with Cythereida. Of the species enumerated, all are marine excepting *C. lacustris* and *torosa*, the former of which occurs in fresh water, but seems to be excessively rare; the latter mostly in brackish, though it has in one or two instances been found in fresh water. In the brackish pools of our salt marshes, and amongst estuarine mud, it often occurs in prodigious numbers. The powerfully chelate right foot of the first pair in the male is a remarkable character of this genus, and is interesting as showing a similarity of plan between this and other tribes of Entomostraca where the right and left limbs of the male exhibit analogous differences of structure. Somewhat similar differences occur likewise in other genera of Ostracoda, but they are especially well marked in Cythereida. It may be noted that the male of *C. lacustris* has not yet been observed either in Norway or in this country, so that its place in this genus is merely provisional. Its only known British habitats are the North Shaws Loch, Selkirkshire, and the Glasgow and Paisley Canal, where it was found by Mr. D. Robertson.

CYTHEROPSIS, G. O. Sars.—Antennæ much as in Cythere, except that the lower are much more robust. Incisive portion of the first maxilla weak, internal segment rudimentary. Second pair of maxillæ very large and much dilated at the apex, flabelliform, and beset with numerous setæ. Feet alike in male and female. Shell high and compressed in front, depressed and tumid behind; thin, pellucid, and marked with round white papillæ. Marine.

C. declivis (Norman), *Argus*, G. O. Sars.

ILYOBATES, G. O. Sars.—Upper antennæ very stout, five-jointed, the first two joints much thickened. Feet very short, the first two pairs three, the last four-jointed. Right foot of the last pair in the male prehensile, and only three-jointed,

terminal claw very large and strong. Eyes wanting. Shell thin and pellucid, subovate, truncate behind. Marine.

I. prateata, G. O. Sars.—This curious species is at once distinguished by its elongated ovate form and truncate posterior extremity, which is also centrally emarginate. It occurs very sparingly in our seas, having been found only on the Dogger Bank and on the west coast of Scotland. The absence of eyes is accounted for by its habit of burrowing in soft mud.

LOXOCOONCHA, G. O. Sars.—Upper antennæ very slender, six-jointed, the last joint very long, linear, and bearing only long, simple setæ. Lowest seta of the branchial plate of first jaw deflexed. Feet long and slender, alike in male and female. Abdomen terminated by a hairy conical process; post-abdominal lobes bearing two long subequal setæ. Shell sub-rhomboidal or peach-stone shaped, surface mostly marked with regular concentric pittings and small papillæ, sometimes with deep polygonal excavations; posterior dorsal angle obliquely truncate. Hinge formed by four small teeth, two on each valve.

L. impressa (Baird); *granulata*, Sars; *elliptica*, Brady; *tamarindus* (Jones), *guttata* (Norman).

Identical with the genus *Normania*, described by me in the "Transactions of the Zoological Society of London," Vol. v.: the name *Loxococoncha* is however of prior date. The species are all marine, except *L. elliptica*, which inhabits brackish water.*

XESTOLEBERIS, G. O. Sars.—Upper antennæ six-jointed, the last four joints gradually decreasing in length and bearing very short, simple setæ. Feet short, post-abdominal lobes bearing two setæ. Ova and immature young borne within the shell of the female. Shell smooth and polished, ornamented with small round papillæ, depressed in front, in the female very tumid behind. Hinge formed by a dentated crest of the left, which is received into a corresponding excavation of the right valve.

X. aurantia (Baird); *depressa*, G. O. Sars.—Zenker and Sars both agree in the statement that the animals of this genus are viviparous; a point which I have myself had no opportunity of investigating.

X. depressa is a common inhabitant of deep water, while *X. aurantia* is found almost exclusively between tide marks. The former is pearly white, exhibiting most beautiful iridescent tints, and sometimes deeply tinged with red at the anterior extremity. The latter is yellowish brown in colour, and has no iridescence.

* The remaining genera are entirely marine.

CYTHERURA, G. O. Sars.—Upper antennæ shortly setose, six-jointed; lower, five-jointed, terminal claws very short. Feet small, the terminal claws short and curved. Male copulative organs very complex, provided with several irregular processes and a very long spirally convoluted tube. Valves unequal and dissimilar in form, the right overlapping on the dorsal margin; produced into a more or less prominent beak behind; surface smooth or variously sculptured, mostly marked with a central areola of darker colour than the rest of the shell.

C. nigrescens (Baird), *angulata*, Brady; *striata*, G. O. Sars; *lineata*, Brady; *cuneata*, Brady; *Sarsii*, Brady; *similis*, G. O. Sars; *undata*, G. O. Sars; *producta*, Brady; *affinis*, G. O. Sars; *gibba* (Müller); *Robertsoni*, Brady; *cornuta*, Brady; *acuticostata*, G. O. Sars; *clathrata*, G. O. Sars; *cellulosa* (Norman).

The members of this genus are the most minute, speaking generally, of all the Cytheridæ, and the specific differences are not always very clear; more extended observation will, doubtless, reveal many more species. Those now known inhabit chiefly deep water; but *C. nigrescens*, and occasionally some others, are to be found in tidal pools. Several species are found fossil in the glacial clays. The most striking peculiarity of the genus is the production of the shell into a prominent beak or rostrum behind: the surface of the shell is often irregularly waved or ribbed.

CYTHEROPTERON, G. O. Sars.—Upper antennæ five-jointed, shortly setose, penultimate joint elongated. Feet long and slender, abdomen ending in a long, narrow process. Male copulative organs armed behind with three spiniform processes, one of which is trifurcate. Eyes wanting. Valves unequal, the right overlapping above, produced towards the ventral margin into a broad lateral ala, and forming behind an obtuse beak. Surface marked with shallow round or angular depressions, or with transverse ribs and furrows.

C. subcircinatum, G. O. Sars; *latissimum* (Norman); *nodosum*, Brady; *punctatum*, Brady; (?) *multiformum* (Norman).

A genus well characterized by the strongly projecting lateral alæ, and great tumidity, in which, however, some species of the following genus very closely resemble it:—

BYTHOCYTHERE, G. O. Sars.—Upper antennæ seven-jointed, second joint very thick, and having a single seta on each margin; the other joints much narrower, forming a slender setose lash. Mandibles constricted above the distal extremity, and bearing a well-developed branchial plate. Branchial plate of second maxilla large, numerous ciliated, the four lower cilia deflexed. Feet elongated; basal joint of the first pair

bearing a small lobe, from which spring two large and two small setæ. Abdomen ending in a very long acuminate process; post-abdominal lobes narrow, bearing three hairs. Valves unequal, smooth, or sparingly sculptured.

B. simplex (Norman); *turgida*, G. O. Sars.—It would not be supposed, from the external appearance of these two species, that they ought to be referred to one and the same genus; their anatomical characters, however, seem to agree closely. The former is a much elongated species, acutely pointed at the posterior extremity; the latter very tumid, subtruncate behind, and much resembling, in general contour, the preceding genus: it is pretty generally distributed, while *B. simplex* appears to be confined to Scotland and the northern part of England. *B. simplex* approaches a form described by Professor T. Rupert Jones from fossil specimens under the name *Bairdia Harrisiana*.

PSEUDOCYTHERE, G. O. Sars.—Upper antennæ seven-jointed, bearing long setæ; second joint thick and armed with a single seta in front; last joint long and narrow, terminated by very long setæ; lower antennæ very slender. Mandibles small and weak. Three lowermost setæ of branchial plate of first maxilla deflexed. Feet very long and slender. Abdomen ending in a long slender process. No eye. Shell thin and pellucid, rounded in front, produced at the posterodorsal angle.

P. caudata, G. O. Sars.—This genus contains only one species, which is a very remarkable one, and apparently uncommon. The shell is subquadrangular in outline, and so much compressed as to appear almost squamous at the posterior ventral extremity, where it is once or twice minutely toothed. Colour brown, owing to the transparency of the shell, through which the animal itself is seen. Its range is extensive; the few British specimens yet taken are from Connamara, Northumberland, Shetland, and the Channel Islands.

CYTHERIDEIS, Jones.—Carapace as seen from the side, much attenuated in front, highest behind. Hinge margins nearly simple: right valve overlapping the left in the middle of the ventral surface. Animal unknown.

C. subulata, Brady.

The name Cytherideis was proposed by Professor T. Rupert Jones, for a group of species which agreed in presenting a peculiar hinge structure, the margin of one valve projecting in a sort of angular crest, the other being cut away, so as to receive it. The genus was not in any case very definite in its characters, and its members must now be looked upon as distributed amongst several other genera; but the species above-named (*C. subulata*) cannot at present, from want of

knowledge of its anatomy, be certainly classed under any other head; the overlapping right valve precludes the notion of its belonging to *Paradoxostoma*, with which, in other respects, it shows considerable agreement. I therefore retain for it the name *Cytherideis*. This species is described by Dr. Baird as *Cythere flavida*, Müller; but the two are most probably quite distinct: the latter species appears to be a yellow variety of *Paradoxostoma variabile*.

SCLEROCILUS, G. O. Sars.—Antennæ robust, the lower larger than the upper; flagellum long and very slender; poison glands large and many-lobed; mouth produced, conical; labrum strongly toothed; mandible small; terminal lobes of the first pair of jaws partially wanting; branchial plate narrow, almost lanceolate; feet short and robust, the first pair having a strong spine at the apex of the basal joint; post-abdominal lobes very large; valves elongated, hard, especially at the edges; surface smooth and shining.

S. contortus (Norman).—This species shows, in the structure of the mouth and mandibles, a state intermediate between the typical *Cytheridæ* and *Paradoxostoma*.

PARADOXOSTOMA (Fischer).—Upper antennæ exceedingly slender, six-jointed and shortly setose; lower shorter and more robust, five-jointed, flagellum very large and stout; poison glands large, lobulated; mouth suctorial; labrum and labium forming together a large and stout subconical process, projecting downwards, and terminating in a disk, in the middle of which the orifice of the mouth is situated. Mandibles very slender, protractile, styliform; palp very slender, and without a branchial appendage. Terminal lobes of the first maxillæ very narrow, two lower setæ of the branchial plate deflexed. Feet short and robust, last joint elongated, terminal claws short and curved; basal joint of the first pair bearing a single strong spine; one eye; shell thin and fragile, having no definite structure; valves subequal, mostly higher in front than behind; ventral margins emarginate in front, so that when the valves are closed there is left an elongated orifice, through which the suctorial apparatus can be protruded.

P. variabile (Baird); *abbreviatum*, G. O. Sars; *Normani*, Brady; *pulchellum*, G. O. Sars; *obliquum*, G. O. Sars; *Hibernicum*, Brady; *Sarniense*, Brady; *ensiforme*, Brady; *flexuosum*, Brady; *arcuatum*, Brady.

The remarkable suctorial mouth of these animals at once separates them from all other genera, and even without examination of the internal parts, the shell itself gives evidence as to its affinities by the longitudinal aperture between the two valves on the anterior portion of the ventral surface; this opening, through which the mandibles and mouth can be protruded, is

usually very distinct. Sars considers it most likely that these creatures derive their nutriment from the juices of the fuci, etc., amongst which they are usually found, for though the structure of the suctorial apparatus is very much akin to that of the parasitic Entomostraca, none of the Ostracoda have ever been found as parasites. It is, indeed, impossible to regard the members of this genus as parasitic, but neither do I think it likely that the poison gland and urticating setæ, which are with them very largely developed, can be meant to assist the creatures to prey upon *vegetable* food. It seems more likely that they serve an office similar to the urticating filaments of the Actiniæ in paralyzing the more minute animal organisms on which their owners probably subsist.

The genus is an especially littoral one, almost all its members being met with in tidal pools, though some of them range also into and beyond the Laminarian zone. The shell is usually very thin, pellucid, and variously marked with shades of olive, deep purple, or black.

Family—CYPRIDINIDÆ, Baird.

PHILOMEDES, Lilljeborg.—Upper antennæ six-jointed, scarcely attenuated at the apex, antepenultimate joint bearing a stout seta, which is set with numerous long auditory cilia; last joint short, and bearing two setæ, which are much longer than the antenna itself. Secondary branch of lower antenna, three-jointed, geniculated, last joint turned upwards. First pair of jaws slender, palp bearing simply a small trisetose lobe; second pair having neither a mandibuliform appendage, nor clawed spines. Animal swimming with long jerks.

P. interpuncta (Baird).—This is the most abundant of the British Cypridinidæ, being sometimes taken in considerable numbers by the towing-net, and occasionally in tidal pools. It ranges, in our islands, from Guernsey to Shetland. The shell is thinner than in others of the family, and often finely reticulated on the surface. Identical with *P. longicornis*, Lilljeborg.

CYLINDROLEBERIS, nov. gen.—Upper antennæ of the *male* (Fig. 11) bearing at the apex two excessively long, annulated setæ, four shorter setæ and a short curved claw; penultimate joint bearing at its apex a stout, densely ciliated auditory seta; upper antenna of the *female* (Fig. 12) terminated by a stout curved claw, and six or seven subequal plumose setæ, which do not exceed in length that of the last four joints; penultimate joint bearing a stout seta or process, from the extremity of which spring six similar setæ. Second joint of the natatory

branch of the lower antenna in the *male* elongated; in the *female* scarcely longer than the succeeding joints; secondary branch in the *male* (Fig. 13) robust, subchelate, terminal joint slender, curved upwards; in the *female* simple, triarticulate, last joint setiform. Antepenultimate joint of the mandibular foot shorter than the following joint, bearing three long subequal curved setæ, two of which are plumose; last joint very short, armed with a curved claw and several setæ. First maxilla, consisting of a broad subquadrate or crescentic lamina, densely clothed on its distal side with long bristles; second pair swollen at the base, suddenly narrowed toward the apex, interruptedly setose; third narrow, uniformly setose. Oviparous foot terminating in two equal dentate lips (Fig. 14), and bearing about six pairs of spinous setæ. Shell elongated, fusiform, or subcylindrical, smooth; beak rounded, and not at all produced; notch narrow. Animal swimming freely.

C. Mariæ (Baird), *teres* (Norman).—Mr. Robertson takes these species in the Frith of Clyde (though never very abundantly) by means of the tow-net, during the night. It would seem, indeed, that these animals do not come to the surface except after sunset. This observation suggests that possibly in fresh-water lakes something might be done by naturalists during the "wee sma' hours ayont the twal."

BRADYCINETUS, G. O. Sars.—Terminal setæ of the upper antenna short and subequal. Secondary branch of the lower antenna in the *female* (Fig. 15) small and biarticulate, the last joint obtuse, and bearing at the apex a flexuous seta; in the *male* larger, three-jointed, the last joint long and membranaceous, terminating in two short setæ. Mandibular feet (Fig. 16) armed with a bifurcate process, in front of which are three toothed spines. Second pair of jaws having a strong mandibuliform appendage, composed of two robust tooth-like processes. Eyes small, and of pale colour. Animal mostly crawling slowly amongst mud. Shell much thicker and stronger than in the preceding genera, produced in front into a large beak, with a deep subjacent notch.

B. Brenda (Baird), *MacAndrei* (Baird).

Family—CONCHOECIADÆ.

CONCHOECIA, G. O. Sars.—This is the only genus of the family, and is sufficiently described previously (pp. 115, 116).

One specimen only has been seen in Britain, and is probably referable to *C. obtusata*, G. O. Sars. It was found by the Rev. A. M. Norman, in sand dredged off Shetland.

Family—POLYCOPEIDÆ.

POLYCOPE, G. O. Sars.—The principal characters of this genus are those of the family to which it belongs, and of which it is the only member.

P. orbicularis, Sars.; *dentata*, Brady.—The first-named species is probably not very uncommon, but owing to its small size— $\frac{1}{5}$ th of an inch—is very likely to be often overlooked. It has occurred in Connemara, Shetland, and the West of Scotland. The shell is almost spherical, and often beautifully punctate and marked out into polygonal areolæ. Of the second species only one example has yet been found; this occurred to Mr. Norman in the same gathering as that which yielded the *Conchoecia*. According to the investigations of G. O. Sars, these animals are wonderfully active in the water, having no less than ten limbs adapted for swimming.

Family—CYTHERELLIDÆ.

CYTHERELLA, Bosquet.—The anatomical structure has been noticed in the description of the family. The shell is very thick and dense in structure, the lateral outline mostly elliptical, and the hinge formed by a simple grooving of the edge of one valve into which the margin of the opposite valve is received. The "lucid" spots* are arranged in a curved pinnate series.

C. Scotica, Brady; *levis*, Brady.—Both species are very rare, and hitherto have been found only amongst the Hebrides. The former is closely allied to a Norwegian species described by Sars—*C. abyssorum*. Several fossil species have been described by various authors; the great thickness and durability of the shell may perhaps account for this.

EXPLANATION OF PLATE I.

Fig. 1.—Illustrating the anatomy of the female of the genus *Cypris*: *a*, eye; *b*, upper antenna; *c*, lower antenna; *d*, mandible proper; *e*, its branchial appendage; *f*, its palp; *g*, first maxilla; *h*, its branchial plate; *i*, second maxilla, with branchial appendage; *j*, first foot; *k*, second foot; *l*, abdomen; *m*, post-abdominal ramus; *n*, alimentary canal; *o*, ovary.

Fig. 2 illustrates the anatomy of the genus *Cythere*: the letters used refer to the same organs as in *Cypris*, except those

* These, though existing in all Ostracoda, have not, for the sake of brevity, been previously noticed, though they sometimes afford good generic characters. They are, in fact, thin, depressed portions of the shell which afford attachment to the muscular bands by which the animal is attached, and by which it is enabled to close the valves firmly.

following: *r*, *s*, *t*, first, second, and third feet; *v*, poison gland, communicating with the urticating seta (flagellum) of the lower antenna.

Fig. 3.—Rudimentary post-abdominal ramus of *Cypridopsis*.

Fig. 4.—“Glandula mucosa” of male *Candona candida*.

Fig. 5.—Second foot of *Pontocypris mytiloides*.

Fig. 6.—Post-abdominal ramus of *P. trigonella*.

Fig. 7.—Upper antenna of *Limnocythere inopinata*.

Fig. 8.—Upper antenna of *Cytheridea papillosa*.

Fig. 9.—Abdomen and post-abdominal setæ of *Cytheridea torosa*.

EXPLANATION OF PLATE II.

Fig. 10.—Illustrating the anatomy of *Bradycinetus* (adapted from Lilljeborg): the letters are used with the same references as above, except the following: *r*, secondary branch of lower antenna; *s*, mandibular appendages of branchial plate of second maxilla.

Fig. 11.—Upper antenna of male *Cylindroleberis Mariae*.

Fig. 12.—Upper antenna of female *Cylindroleberis Mariae*.

Fig. 13.—Secondary branch of lower antenna of male *Cylindroleberis Mariae*.

Fig. 14.—Termination of oviferous foot of *Cylindroleberis Mariae*.

Fig. 15.—Secondary branch of lower antenna of female *Bradycinetus MacAndrei*.

Fig. 16.—Mandibular foot of *Bradycinetus Brenda*.

Fig. 17.—Termination of oviferous foot of *Philomedes interpuncta*.

Fig. 18.—Post-abdomen of *Philomedes interpuncta*, seen from below.

AN APRIL CLIMB IN THE HIMALAYAS.

BY GEORGE E. BULGER,

Captain, 10th Regiment.

THE morning of April 6th, 1867, looked rather more promising than usual.* The sun peeped out at intervals from the light cumuloïd clouds that screened the eastern heavens; and even the white peaks of the snowy range were faintly visible when we started from our residence on the west side of Jella Pahar, with the intention of walking to the summit of the great mountain called Sinchul, distant, perhaps, some six or eight miles from Darjeeling, and 8600 feet above the level of the sea. This noble hill—one of the loftiest in British Sikkim—is a grand and striking object from any point of view; and its numerous spurs and ramifications furnish nearly all the greater summits in the neighbourhood, upon which are built the stations of Jella Pahar and Darjeeling, and the settlements of Leebong, Tukvar, Dooteriah, Senadah, and Hope Town.

Having crossed the ridge of Jella Pahar, we found ourselves in the main road, leading, with a gentle slope, from a dip in the mountain called the “saddle” to the Sinchul barracks, which are situated fully six hundred feet higher up. But before we had gone very far, great piles of mist began to rise from the khuds and valleys below, ever and anon shutting out the view of all objects beyond a hundred yards, and threatening, ere long, to shroud the entire prospect, for the remainder of the day, in a dense mantle of heavy cloud.

The road winds slowly upwards, passing through the mutilated remains of glorious forests, that once overspread this mountain-side from base to summit, but which now, alas, in the vicinity of the highway and the military station, are very nearly obliterated from the soil that fed and nourished them, for, perhaps, thousands of years before the axe or the clearing-fire brought destruction amidst some of the fairest scenes on earth. But, even here, all the trees are not yet gone, and aged giants of towering height and huge proportions, gnarled, moss-covered, green with orchids, and festooned with climbers, still stand, among the unsightly stumps of their departed brethren, perfect marvels of magnitude, grandeur, and solemn majesty.

The walk to Sinchul is, to me, a somewhat melancholy one,

* The weather at Darjeeling and its vicinity has, this year, been almost continually cloudy since the end of March, as, possibly, before that time also.