

“*how* do volcanic eruptions produce cyclones?” without more numerous and more careful observations than we possess at present, would be premature, and, therefore, unsuccessful.

It may be well to mention, that such a relation is countenanced by the geographical position of the hurricane regions with respect to the chief volcanic districts. The West Indian cyclones first settle upon the ocean near the Leeward Islands, a chain of active volcanic vents. The Mauritius cyclones proceed immediately from the great volcanic district of Java, Sumatra, &c. The cyclones of the Bay of Bengal, and the typhoons of the Chinese Sea, proceed from the neighbourhood of chains of volcanic islands situated on the eastern boundary of their respective localities. The majority of the hurricanes in the Southern Pacific Ocean which I have investigated appear to emerge from New Guinea, New Britain, and the other volcanic islands near to Torres' Straits.

XV. *On some of the Species of Daphniadæ found in New South Wales.* By the Rev. R. L. KING, B.A. [Read 9th June, 1852.]

THE animals which I am about to describe belong to the crustaceous genera, which have been placed by Müller, Latreille, and later writers in the great division of the Entomostraca. My attention was directed to the search for them by reading the admirable memoir of the British Entomostraca, (by Mr. Baird), published in 1849 by the Ray Society. As the forms and various particulars of the British species have been so fully detailed in that work,

I shall endeavour, in describing the Australian species, to follow the example of so able a master.

For the benefit of those who have not access to Mr. Baird's interesting work, nor to those of Latreille, Milne Edwards, and others who preceded him, it may be useful to give at length the character of the different subdivisions of the Entomostraca under which the genera here to be mentioned are placed.

ENTOMOSTRACA. (Müll.)

The Entomostraca (a subdivision of the large class Crustacea) may be characterized by their being all aquatic; by their being covered in general with a shell, or carapace, which is of a horny or coriaceous texture, and formed of one or more pieces, in some approaching in appearance to a bivalve shell,—in others being in the form of a buckler, which completely, or in a great part, envelopes the body of the animal; by their having branchiæ attached either to the feet or to the organs of mastication; by their feet being jointed, and all more or less ciliated; and by their undergoing a regular moulting or change of shell as they grow, in some amounting to a species of transformation.

The Entomostraca have been divided into three parts,—the *Branchiopoda*, the *Lophyropoda*, and the *Pæcilopoda*: of these we are at present only concerned with the

BRANCHIOPODA. (Latr.)

Character.—Mouth furnished with organs fitted for mastication; branchiæ many, attached to the feet; body sometimes naked, but more frequently having an envelope in the form of a buckler—in some enclosing only the head and thorax, in others the whole body; feet varying in number, all branchiferous; antennæ two or four, jointed,

and generally ciliated; eyes sometimes two or even three, but frequently only one, that is, so closely approximated as to appear and even to be single. They are all free and unattached, swimming at large in the water.

There are only two orders of *Branchiopoda*, viz.,—*Phyllopoda* (Latr.), and *Cladocera*. (Latr.). Both have representatives among the Australian Entomostraca. The present paper refers to the latter.

The *Cladocera*, as an order, may be characterized as follows:—

Body, except the head, which is distinct and projecting, entirely enclosed within a carapace formed of two valves joined together on the back. Feet, four to six pairs; articulations partly cylindrical, but chiefly foliaceous, branchioform, and not much adapted for organs of motion. Eye single, and very large. Antennæ, two pairs; inferior branched, large, performing the functions of swimming organs. Mandibles without palpi.

The *Cladocera* are divided into three families—*Daphniadæ*, *Polyphemidæ*, and *Lynceidæ*. Of these, the first alone claim our attention at present.

DAPHNIADÆ.

Character.—Inferior antennæ, almost always two-branched. Five or six pairs of feet, all enclosed within the valves of the carapace. Eye single, large. Intestine nearly straight.

Mr. Baird has divided this family into the two parts *Daphnina* and *Sidina*. Of the latter, I have not as yet met with Australian representatives.

DAPHNINA.

Character.—Five pairs of feet. Inferior antennæ,

each two-branched; one branch composed of four, the other of three articulations.

Genus DAPHNIA. (Müller.)

Head produced downwards into a more or less prominent beak. Superior antennæ, generally small and one-jointed, situated under the beak.

(1.) *Daphnia carinata*. (Plate I.)—The valves of the shell or carapace are oval; nearly colourless; irregularly reticulated. The head is large and rounded, particularly in the variety marked B. The anterior part generally comes to a sharp point. The front view of the head has a singularly carinated appearance.

The superior antennæ are very small, hardly to be distinguished, except with a high power of the microscope. Each consists simply of a thickened lump, from which nine setæ spring. The inferior antennæ are of moderate size; the articulations rough, with short spines irregularly dispersed over them. The setæ are short and thickly plumose.

The posterior angle of the shell terminates in a long sharp point closely serrated along both sides; the serræ extending along the dorsal margin half way to the head, and along the margins of the valves through a considerable portion of their length. They are larger in the young individuals than in the older.

The eye is large. The sixth segment of the body has three projections, one directed upwards supporting the ova.

This species in many respects resembles *D. Psittacea* (BAIRD). Its greater size—the smallness of the superior antennæ, and the roundness of head and sharpness of its beak—sufficiently distinguish it from the English species.

The male is much smaller than the female, and the shell narrower. The superior antennæ are large, springing from under the beak, ending in one long stout-jointed seta and several smaller ones.

Its habits are not active, consequently it is generally covered with vorticellæ, which much impede its movements. It never clings to the stems of weeds, or the side of the vessel in which it is kept, as the next species does.

Var. B.—I have only noticed, and that rarely, in the swamps connected with Botany Bay. I have *not* seen it with ova or ephippia. I have almost doubted whether it is not entitled to be regarded as a different species.

Var. C.—Is remarkable for the number of its eggs. The specimen figured had between 70 and 80. It was found in a small ditch near Sydney, associated with a multitude of Cyclops. Localities :—Ponds near Sydney, Parramatta, Campbelltown, &c.

(2.) *Daphnia Elizabethæ*. (Plate II.)—Carapace oblong (in *gravid* females ovate); obliquely striated, the striae sometimes anastomosing, but seldom, if ever, crossing. The inter-spaces are punctured irregularly, anterior margin ciliated; spine none.

The head is obtuse; beak short, a black spot close to the beak. Superior antennæ large, consisting of a stout-curved joint (which is articulated to the base of the beak?*) From its extremity eight or nine setæ spring; an additional seta is placed on a short process near the base. The filaments of the superior antennæ are jointed and thinly plumose. A short spine rises from the extremity of the second joint of the anterior branch. The basilar

* I put a query to this, because I have not seen the joint moved, although I have no doubt that it does move.

joint has also two jointed setæ springing from one of the wrinkles in its outer surface, about half way up; and a short-jointed seta from the outer edge of its extremity.

The extremity of the abdomen is more distinctly jointed than in most species of this genus. It has two small processes, one springing from each articulation.

The extremity terminates in two long spines, which are sometimes deeply serrated, at other times plain.

The anus is surrounded by a circle of 12-14 strong curved spines.

The colour is variable. Those near Sydney are of a transparent chestnut colour. At Port Stephens, in a small pond, I found a large variety of a pinkish colour; while in the River Karuah the specimens were small and of a brown colour, marked with bands of a deeper colour.

The black spot is often seen of an elongated form. I have seen one end moved as the labrum moved, with which it appeared to be connected.

This species is remarkably like *Daphnia vetula* (BAIRD), although easily distinguished by the particulars of the antennæ, superior and inferior, as well as the character of the extremity of the abdomen. It even more closely resembles the figures of *D. sima* in JURINE, though I dare not pronounce the species to be identical.

The normal state is represented by fig. B.

When the female becomes gravid more room is required, and the shape becomes more ovate, as in fig. A.

I have not as yet found the male.

Its habits are not very active. It swims fast, and yet it often clings to the sides of the glass in which it is kept, or to the stems of weeds, or the roots of Lemnæ, by throwing back its inferior antennæ; and in this position

it will remain for a considerable time. The anterior branch of the inferior antennæ is generally kept in a curved position when the animal is at rest.

I have named the species after Miss King, of whose kind assistance in my search for Entomostraca the discovery of this species was the first fruit. Localities :—This species is widely distributed;—I have found it at Sydney, New Town, Parramatta, the Cowpastures, and in the River Karuah, near Stroud, Port Stephens.

(3.) *Daphnia honorata*. (Plate III).—Carapace oblong, dorsal margin often concave, the surface reticulated in an irregular pentagonal manner. The spine at the extremity is very short.

Superior antennæ large. Inferior also large, the basilar joint having a crenation carrying two setæ. The first joint of the posterior branch is as long as the remaining two, and as long also as the first three of the anterior branch. Setæ not plumose.

The sixth segment of the body has one small process, directed backwards. The segment itself is large, and much resembles the corresponding part in many of the Lynceidæ.

The proportions of the joints of its inferior antennæ readily distinguish it from *D. reticulata* and *D. rotunda* (BAIRD), which it very much resembles.

Male unknown. Locality :—I have hitherto only found this interesting species in one locality,—a small pond in the gardens at Varroville, near Campbell Town.

Genus MOINA. (Baird.)

Head obtuse; not produced into a beak. Superior antennæ of considerable length; one jointed, arising from

the front of the head near the centre. Inferior antennæ very large, and generally fleshy at the base.

(1.) *Moina lemnæ*. (Plate IV).—Head round, giving the animal a singularly graceful outline. Carapace oval, smooth. There are setæ in the anterior surface and margin of the valves as far as the ventral angle.

Superior antennæ long, with a few minute setæ springing from the upper edge. The basilar joint of the inferior antennæ is stout and fleshy, having two setæ springing from a crenation on the outer side, and a short seta or spine from the top of the joint at the *inner* edge. A similar short spine springs from the extremity of the second joint of the anterior branch, and another from the fourth joint of the same. Each branch has five jointed and plumose setæ.

Near the base of the superior antennæ is a small black spot.

The first pair of feet are replaced by an organ apparently adapted for clasping the roots of the lemnæ and fibres of confervæ, among which I found it. It consists of two fleshy hooks, one of which is partially moveable. The use which I have assigned to it is conjectural. I have almost doubted whether the possession of this organ does not remove it from the genus *Moina*.

The extremity of the abdomen is like that of *Daphnia*, except that it has no processes, nor any circle of spines round the anus.

The eye of the fœtus is double. But the two eyes unite, and in the adult the eye is single and nearly round. In some specimens, however, there is a notch at the bottom of the eye (seen when the animal is viewed in front), a mark of its former divided state.

The profile is subject to a little variation. I have not as yet discovered the male.

The habits are rather sluggish. Locality :—A small pond in a garden at Cook's River, near Sydney.

(2.) *Moina Macleayii*. (Plate V). Head triangular; the eye in the apex of the triangle, large; carapace roundish-oval, smooth, without setæ on the margin. The superior antennæ are long, with a single seta springing from the upper edge. The inferior antennæ have the basilar joint of moderate size; a single seta springs from one of the crenations on the side, and a jointed seta, nearly as long as the posterior branch of the antennæ, springs from the top. The anterior branch has four short plumose setæ springing from the extremity of the last articulation, and one from the penultimate. The posterior branch has three short-jointed setæ and a short spine springing from the extremity of the last articulation—one longer from the penultimate, and one still longer from the antepenultimate. The last segment of the abdomen is longer than in *M. lemnæ*, and has one small process directed upwards, closing the receptacle for the ova. There are small spines round the anus.

The long seta on the posterior branch of the inferior antennæ brings this species near the genus *Macrothrix* (BAIRD), from which, however, it differs in the character of the superior antennæ.

The habits are rather active. It clings to the side of the glass at times (but rarely), like *Daphnia Elizabethæ*. The male is unknown.

I have dedicated this pretty species to my friend W. S. M'Leay, Esq., by his kind permission (in whose company it was captured in a small pond near his garden at Elizabeth

Bay), as a trifling acknowledgment of his kind advice and assistance in my study of the family. Locality:—Pond near Elizabeth Bay, Sydney.

Of the species here enumerated, three are confined, as far as is known at present, to single localities,—*Daphnia honorata*, *Moina lemnæ*, and *Moina Macleayii*. *Daphnia Elizabethæ* has an extended range, having been noticed in localities 130 miles apart; and if on further examination it should appear identical with the *Daphnia sima* (*Auctorum*,—*Daphnia vetula* of Baird's Brit. Entomost.), which is not unlikely, we shall have a singular link between the Australian and the European Entomostraca.

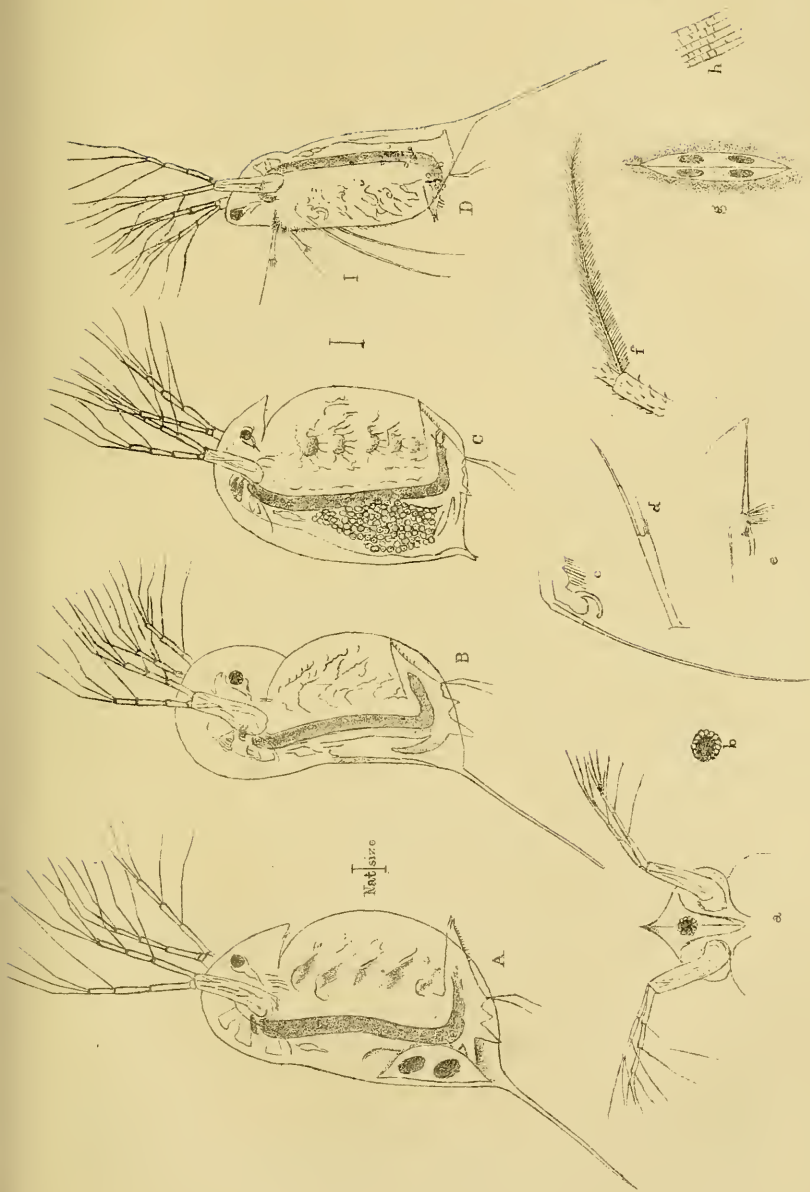
I trust that I may be allowed to express the hope that the Tasmanian contributors to the Journal in which this paper appears will mention what species are found in Van Diemen's Land.

In my next communication I hope to describe the species I have met with in this neighbourhood of the family *Lynceidæ*.

Explanation of the Figures.

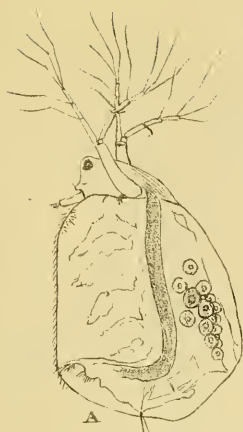
Plate I. *Daphnia Carinata.*

- A. The common form, with the Ehippium.
- B. C. Varieties.
- D. Male.
- a. Portrait of A; b. the eye, front view; c. clasping feet of male; d. superior antennæ of male; e. superior ant. of female; f. seta of inferior antenna of female; g. back view of ehippium; h. marks on carapace.

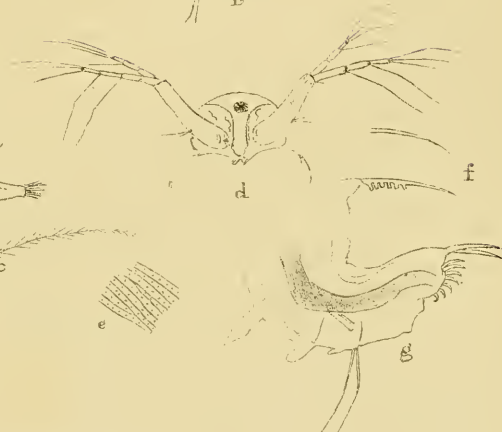
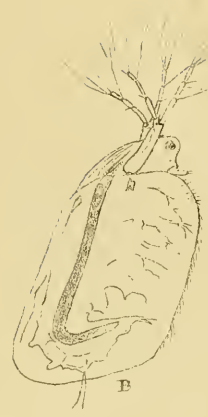


Daphnia carinata.

A, B, C, females. D, male.



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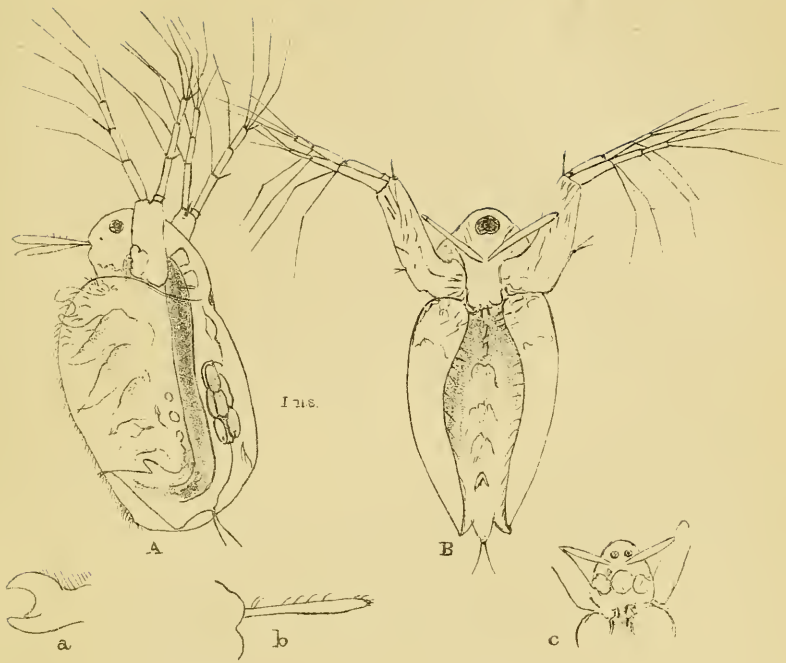
Daphnia Elizabetha.



I n.s.



Daphnia honorata.



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A

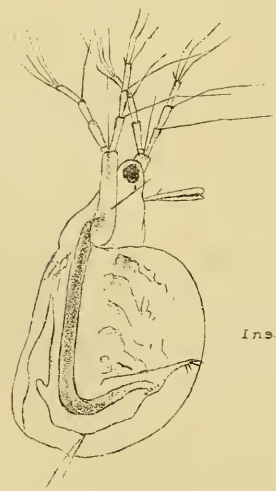
B

a

b

c

— *Moina lemnae*



Ins

Moina Macleayii.

Plate II. *Daphnia Elizabethæ.*

- | | |
|------------------------------|---------------------------|
| A. Gravid female. | d. Portrait. |
| B. Female not gravid. | e. Marks on carapace. |
| a. Inferior antenna. | f. Spines at extremity of |
| b. Superior antenna. | abdomen. |
| c. Seta or inferior antenna. | g. Extremity of abdomen. |

Plate III. *Daphnia honorata.*

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|------------------------|-----------------------|
| A. Side view, female. | a. Superior antenna. |
| B. Front view, female. | b. Marks on carapace. |
| | c. Inferior antenna. |

Plate IV. *Moina lemnae.*

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|------------------------|-------------------------|
| A. Side view, female. | a. Clasping apparatus. |
| B. Front view, female. | b. Superior antenna. |
| | c. Front view of young. |

Plate V. *Moina Macleayi.*

- A. Side view of female.

XVI. On Australian Entomostracans—in continuation.
 By the REV. R. L. KING, of Sydney. [Read 8th
 December, 1852.]

IN my former paper on the Australian Entomostracans, I described five species belonging to the genera *Daphnia* and *Moina*. I have since met with some remarkable varieties of those described, as well as two additional species of the same family.

Daphnia carinata. var. *gravis.* (Plate VI. A.)—
 This variety (of which I have figured an almost monstrous specimen) occurs constantly in the winter months in small ponds. It attains a larger size than the normal state.