

35. A Revision of the Isopod Genus *Ligia* (Fabricius). By HAROLD GORDON JACKSON, M.Sc., F.Z.S.; Reader in Zoology in the University of London, at Birkbeck College.

[Received May 11, 1922: Read June 13, 1922.]

(Plates I. & II. *)

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(1) *Preface.*

This paper on the genus *Ligia* is intended to be the first of a series dealing with the Terrestrial Isopods. The opportunity of undertaking the work was given to me by Dr. W. T. Calman, F.R.S., who placed at my disposal the material, now in the possession of the British Museum, which belonged to the late G. Budde-Lund. The author of 'Isopoda Terrestria' evidently intended to use this material, which comprises specimens of most known species of terrestrial Isopods, for the revision of his great work on which he was engaged at the time of his death. He was only able to complete the genera *Eubelum*, *Armadillo*, and the sub-family Spherilloninæ, but he left notes of observations on other genera which will be referred to in their proper place. I propose

* For explanation of the Plates see p. 703.

to endeavour to carry on, from the place at which it was left by Budde-Lund, the task of making a critical revision of the 'Isopoda Terrestria,' with the aid of his collection and other material in the Museum.

I should like here to pay tribute to the generosity with which Dr. Calman has always put his unrivalled knowledge of the Crustacea at my disposal during this investigation; my grateful thanks are also due to my wife for many of the figures illustrating this paper and a great deal of other tedious work, and to Mr. Frank Forty for his excellent figures of *L. pigmentata* and *L. perkinsi*.

(2) Introduction.

Budde-Lund recognised seventeen species in the genus *Ligia*, five of which he had not seen and therefore did not describe. Since the publication of 'Isopoda Terrestria' several new species have been created, three of which still stand, some of the doubtful species have been set on their feet, and the genus *Geoligia* has been created to contain two purely terrestrial Ligiidæ. Budde-Lund's descriptions were always in Latin and, valuable as they are, were often extremely sketchy; and no serious attempt was made to describe thoroughly any species of *Ligia* until Sars in 1899 gave his classic diagnosis and figures of *Ligia oceanica*. Later, in 1901 and 1916, Chilton did an equally admirable service for *Ligia novæ-zealandicæ* and *exotica*. Not all modern descriptions have improved greatly on their predecessors, although Miss Richardson has given careful accounts of the American species of *Ligia*.

Having had the privilege of examining an extended series of forms, I have been in a very favourable position for weighing the relative importance of various characters in discriminating between species. In descriptions of new species, characters are again and again cited as specific which are found on examination to be generic, but not referred to—either being considered as unimportant or not having been noticed—by previous authors. For example, such a careful and reliable writer as Chilton gives "transverse depression just posterior to the angle of the eye, interrupted in the middle" as a specific character of *Ligia novæ-zealandicæ*, when, in fact, there is no *Ligia* of any species I have seen in which this "depression" is absent.

(3) Sexual Characters.

The very marked sexual differences have been a stumbling-block in the recognition of genuine species.

The secondary sexual characters in which the sexes differ are as follows:—

1. The antennæ of the male are usually relatively longer than those of the female and are frequently stouter, though not in all species.

2. The peræopods often possess well-marked processes or spines in the male only, and also frequently bear a plate-like expansion covered with file-like serrations on two or more segments of the first two or three legs, as has already been remarked by Chilton in *Ligia oceanica* (1899). The feature is constant enough to justify the conjecture that it is of value in holding the female in pairing.

3. The sutures between coxal plates and terga are frequently well marked on the dorsal surface of three or more segments of the thorax of the female, but in the male there is rarely more than the faintest indication of the suture. This character will be referred to in detail in the description of each species and in the discussion on *Geoligia*.

4. The male is usually larger than the female, but frequently relatively narrower; doubtless this difference is associated with the brood-pouch of the latter.

It follows from this that descriptions of species founded on any of the above characters, in which the sex is not named, must be looked upon with suspicion. As far as possible I have always noted in the following pages characters in which the sexes differ, or have stated on which sex the description has been based.

(4) *Generic and Specific Characters.*

Nearly every external character possessed by *Ligia* has been used from time to time for systematic work. As these characters are of very unequal value, I will pass them in review and endeavour to justify the characters on which I have based my descriptions.

The *proportions* of the body and the *size* vary with age and sex, but bearing that in mind, they may be a valuable guide.

The shape of the *somites* of the body differs very little in the different species. As a rule the hinder margins of the first three thoracic somites are transverse and the remainder progressively more and more curved, and the coxal plates are drawn out into progressively longer backwardly-directed spines. The first three or four somites of the thorax are about equal in length and the others successively shorter. Unless there is any strongly marked difference, I have therefore omitted these points in my descriptions.

The *general shape* of the body cannot be described in other terms than "elongate-oval" or the like, so it is unnecessary to repeat it for each species.

The *colour* in the case of preserved specimens, especially if they have been kept in spirit a long time, is almost valueless.

The *surface* of the body is always covered with minute granulations, and the free margins of the somites are beset with minute setæ, but in some species the surface is notably smoother than in others.

The *cephalon* has a transverse groove on its hind border and two somewhat pear-shaped post-orbital pits ("interrupted depression" of Chilton). There are three transverse grooves on the epistome in all species.

The eyes of the same species have been described by different authors as "moderate," "large" or "small." Compared with some nearly related genera, the eyes of any *Ligia* would be large: it is therefore unnecessary to do more in a specific description than compare one species with another.

The *abdomen* (metasome) has the first two somites covered by the last thoracic and without the drawn-out pleural plates possessed by the remaining somites. The difference in width between abdomen and thorax is more marked in some species than in others, but I cannot consider it a good character, as it is distinctly affected by the preservation of the specimen; when the body is flaccid and the anterior abdominal somites are more exposed, the difference is exaggerated. In many species there are indications of lateral oblique carinae on the third, fourth, and fifth abdominal somites. I have noted the character when it is conspicuous.

The *terminal segment* (telson + 6th abdominal somite) varies slightly with every species and is, therefore, a valuable character. The posterior margin may be produced into spines or blunt processes. It may bear a *median process* which may be acute or almost obsolete; the corners may be drawn out into *postero-lateral processes*. On each side above the point of insertion of the uropod the margin may bear two processes (sometimes little more than undulations), the *inner* and *outer accessory processes* (Pl. II. fig. 10).

The key given on p. 689 is based in the first place on the shape of the posterior margin between the two inner accessory processes. If a median process is present, the margins on either side of it, between it and the inner accessory processes of each side, are always, however slightly, concave. Long usage has sanctioned for this type of telson the inaccurate term "triangulate."

On the other hand, an "arcuate" margin is smoothly convex between the inner accessory processes.

It is conceivable that cases may arise which are intermediate between the two types, but the material described below presents no difficulties.

The appendages are of great systematic value.

The *first antennae* are vestigial throughout the genus.

The *second antennae* differ greatly in length, in the character of the segments of the flagellum and in the relative length of the peduncle and flagellum. I have followed Miss Richardson in describing the length of the appendage in relation to the somites of the body, but I cannot follow her in attaching importance to the relative length of the segments of the peduncle. The number of segments of the flagellum is useful as a general indication, but as it sometimes differs on the two sides of the same animal, it must not be taken too seriously.

The *mouth-parts* differ slightly throughout the genus. It is interesting to note that in the majority of species the maxillipede (whose palp has always five separate or indicated joints) and second maxilla differ from those of *Ligia oceanica*, the type of the genus. The first maxilla and the mandible are, however, very constant in structure, on which account I have considered it unnecessary to deal with them under each species.

The *peraeopods* are always biunguiculate. In the males of certain species the inner edges of the first and sometimes second and third leg are deeply suicate. I have not enough material to pronounce on the value of this character, but as I have found it present in some and absent in other specimens collected at the same spot and obviously identical in all other particulars, I feel it necessary to regard it with caution until its significance is known. The sexual differences have been alluded to above.

I have not found the *pleopods* to be of any systematic value.

The *uropods* are frequently distinctive both in shape and size.

(5) *The genus Geoligia.*

This genus was founded by Dollfus in 1893 on a single damaged male specimen obtained from Valencia (Venezuela) at a height of 1200 metres above sea-level. The character on which the genus was separated from *Ligia* was the absence of indication of separation of coxal plates from terga on the thorax, added to the unusual habitat of the specimen.

In 1900 the same author described specimens from the Hawaiian Islands, obtained at heights varying from 2000 feet to 4000 feet, as a new species of the same genus. These differed from the holotype in many particulars, and one male specimen was in possession of a complete uropod of extraordinary form, the rami being composed of several segments. Dollfus accordingly added to the characters of the genus the possession of jointed uropods, and his diagnosis is as follows:—

“Coxopodites (épimères) non ou très peu distincts. Appendices des uropods articulés. Le reste, et notamment les parties buccales, comme dans le genre *Ligia*—espèces terrestres.”

An examination of the degree of separation of the coxal plates from the terga throughout the genus *Ligia* reveals that it would be a most treacherous character on which to found a species, let alone a genus. It is variable, even within a species, but a generalisation that would be true for the majority of cases might be stated thus:—The sutures between the coxal plates and terga are always visible to a greater or lesser extent in the female on the second, third, and fourth thoracic somites; they may be present or absent on the other somites. In the male the sutures may be altogether obliterated (e. g. *L. olfersii*) or well marked on each thoracic somite (e. g. *L. oceanica*).

The original specimens of the Hawaiian *Geoligia perkinsi* are preserved in the British Museum. An examination of the material shows that any generic distinction based on this character must be abandoned, as the females all have this suture well marked on the second, third, and fourth somites.

An examination of the single uropod cannot but raise doubts as to the genuine nature of the "joints." These are at most irregular intervals, and show under a high magnification no arthrodial modification of tissue such as would be found in a natural structure.

It is therefore suggested that the segments of the rami were produced accidentally. Among two dozen specimens of *Ligia evotica*—a species distinguished by the length and slenderness of the uropods—I found two specimens which showed "joints" in the rami, identical in every respect with those of *Geoligia perkinsi*. Further, when placed side by side with a uropod which had been purposely bent, no difference could be detected. The probability that the jointed uropod of *Geoligia* is of accidental origin is therefore exceedingly strong, and the last anatomical difference between *Geoligia* and *Ligia* is thereby removed.

If *G. simoni* and *G. perkinsi* are compared, it will be found that they differ widely from one another in relative size of eyes and head, length of antennæ, shape of telson, and other points. The artificial nature of the genus is shown by the fact that they differ more from each other than each differs from certain species of *Ligia*, and difficulty arises in finding not generic but specific differences between these species and various species of *Ligia*.

In 1915, Pearse (p. 549) described under the name of *Ligyda richardsonæ*, specimens he collected in Cincinnati, Colombia, at 3800 feet elevation. This species greatly resembles *Geoligia simoni*, and occurs at no great distance from it, and it is very probable that collection of more material from Venezuela and Colombia will show that both must be referred to the same species. If habitat is to count for everything in the delimitation of genera, then Pearse should have made a new genus for *L. richardsonæ* or have placed it in Dollfus's genus, of which he seemed unaware. His action in retaining the genus *Ligia* for his new species supports my contention that bionomical considerations should have no weight in the separation of this genus from *Ligia*.

It may be assumed that these three species have arisen from littoral species of *Ligia* which have migrated inland and become slightly modified in so doing. Thus *Geoligia perkinsi* is almost identical with the littoral *L. hawaiiensis*, but *G. simoni* and *L. richardsonæ* present a more difficult problem, as the adjacent littoral species that have been recorded (*L. baudiniana* and *L. olfersii*) do not bear any obvious relation to them. Either they are modified from the *baudiniana* or from an unrecorded New World species resembling *L. italica*, from which they can only with difficulty be distinguished.

I propose, therefore, on the grounds I have given above, to unite *Geoligia* with *Ligia*, and regard *G. simoni* and *G. perkinsi* as species of the latter genus.

(6) *Key to the genus Ligia.*

The following species are omitted from the key as being insufficiently described or of doubtful validity:—*L. ehrenbergii* Brandt, *L. cajennensis* Koch, *L. australiensis* Dana, *L. cursor* Dana, *L. vitiensis* Dana, and *L. malleata* Pfeffer.

The general distribution of each species is given as a possible aid to identification. The key is to be considered as artificial, and not necessarily indicating relationship of forms to one another.

- | | | | |
|-----|---|---|---|
| 1. | { | Posterior margin of telson triangulate | 2. |
| | | Posterior margin of telson arcuate | 9. |
| 2. | { | Process on propodite of 1st leg of male | 3. |
| | | Without process on 1st leg of male | 6. |
| 3. | { | Antennæ longer than thorax in male | 4. |
| | | Antennæ shorter than thorax in male | 5. |
| 4. | { | Telson with blunt median process and blunt accessory processes.
<i>hawaiiensis</i> (Pacific Islands). | |
| | | Telson with acute median process and two acute accessory processes.
<i>exotica</i> (warm seas). | |
| 5. | { | Flagellar joints of antenna short and squat ... <i>cinerascens</i> (Japan). | |
| | | Flagellar joints of antenna long and slender.
<i>occidentalis</i> (tropical W. America). | |
| 6. | { | With comb of long setæ on carpus and merus of 1st leg of male.
<i>baudiniiana</i> (tropical W. America). | |
| | | Without comb on 1st leg of male | 7. |
| 7. | { | Antennæ as long or longer than thorax | 8. |
| | | Antennæ not reaching further than 5th thoracic segment.
<i>pigmentata</i> (Suez). | |
| 8. | { | First leg of male deeply grooved | <i>olfersii</i> (tropical E. America). |
| | | First leg of male without grooves | <i>perkinsi</i> (Hawaiian Islands—terrestrial). |
| 9. | { | Width of body more than half its length | 10. |
| | | Width of body less than half its length | 11. |
| 10. | { | Carpus and merus of 1st leg swollen | <i>pallasii</i> (N.E. America). |
| | | Carpus and merus of 1st leg deeply grooved... .. | <i>dilatata</i> (Cape Peninsula). |
| 11. | { | Antennæ as long or longer than whole body | 12. |
| | | Antennæ shorter than body | 13. |
| 12. | { | Uropods longer than body | <i>gracilipes</i> (S. Africa). |
| | | Uropods not so long as body | <i>natalensis</i> (Natal). |

13. { Postero-lateral processes of telson produced to sharp points..... 14.
 { Postero-lateral processes of telson obsolete, or small and blunt . 15.
14. { Antennæ as long as or longer than thorax, setose.
 novæ-zealandiæ (New Zealand, Chile).
 { Antennæ shorter than thorax, not setose *oceanica* (Europe).
15. { Eyes large and separated by less than their horizontal length... 16.
 { Eyes small and separated by more than their horizontal length. 17.
16. { Flagellum of antenna with about 20 long and slender joints.
 richardsonæ (Colombia—terrestrial).
 { Flagellum of antenna with about 17 short and setose joints.
 glabrata (Cape).
17. { Flagellum of antenna with about 20 joints ... *italica* (Mediterranean).
 { Flagellum of antenna with about 16 joints ... *simoni* (Venezuela—
 terrestrial).

(7) *The genus Ligia*, Fabricius, 1798.

I quote Sars's diagnosis of the genus:—

“Body regularly oval, or oblong oval, moderately convex above, with the metasome not abruptly contracted; last segment rather broad, with distinct epimeral plates. Eyes large and convex. Antennulæ very small, with the last joint rudimentary, nodiform. Antennæ rather strong and elongated. Mandibles with a ciliated lappet and numerous penicils behind the cutting-part. Maxillipeds comparatively short and stout, with the terminal part rather expanded, epignath rounded. Legs gradually increasing in length posteriorly, dactylus distinctly bi-unguiculate. Opercular plate of pleopoda sub-branchial. Uropoda more or less elongated, basal part not produced inside; rami narrow, styliform, subequal, each with a single apical spine.”

The only point that will not hold for the whole genus is that relating to the contraction of the metasome. It may or may not be as broad as the mesosome.

I have thought it desirable to include in the following descriptions, for the sake of uniformity, complete accounts of all species that I have examined, although three of them have been fully described elsewhere. When full synonymy and figures have already been published, I have been content to refer to them when I have been satisfied as to their correctness.

The order in which the characters of each species are dealt with is based on convenience in examination, and does not pretend to any natural or logical order. Although the males and females of a species may differ considerably, I have considered it safe to re-describe some species, and describe a new species from the female only, as, with the data given above, it may be predicted with some certainty in what characters the male may be expected to differ from the female, and to found the specific diagnosis on common characters.

1. *LIGIA OCEANICA* (Linnæus).

Ligyda oceanica Richardson (1905), p. 684 (*q. v.* for complete synonymy).

Ligia oceanica Dahl (1916), p. 32.

Male specimen described.

Length 25 mm. *Breadth* 12 mm.

Surface moderately coarsely granulated. *Eyes* of moderate size, rounded and separated by twice their horizontal length. *Antennæ* moderately long and stout; flagellum reaching as far as the hind border of the 4th thoracic somite, the peduncle half-way down the 2nd somite. Flagellum with 12 to 14 very short and stout segments. *Coxal plates* divided by very distinct grooves from terga of every thoracic somite in both sexes. *Abdomen* not abruptly contracted. *Telson* arcuate; the postero-lateral processes acute and nearly as long as the middle of the hind border; accessory processes not produced, but the inner forming a prominent undulation. *Mouth-parts*: 2nd maxilla bilobed, with two hairy bristles on inner side. Maxillipede palp clearly divided into five joints. 1st *peræopod* of the male only has merus, carpus, and propodus produced on inner side to a flat plate-like expansion, with free border fringed with short setæ. The surface of this expansion is covered by oblique serrations. *Uropods* 7 mm.

Distribution. Hammershus; Cuxhaven; Portsmouth; Northern Seas. (See Richardson (1905) for complete list.)

Figured in full by Sars (1899).

2. *LIGIA PALLASHI* Brandt. (Pl. I. fig. 4.)

Ligyda pallasii Richardson (1905), p. 682 (*q. v.* for synonymy).

Ligyda pallasii Richardson (1909), p. 125.

Male specimen described.

Length 35 mm. *Breadth* 20 mm.

Surface coarsely granulated. *Eyes* of moderate size, rounded and separated by twice their horizontal length. *Antennæ* moderately long and stout; flagellum reaching as far back as hind border of 5th somite, peduncle to hind border of 2nd somite; flagellum with 15 short and stout segments, without large setæ but densely covered with exceedingly minute setæ. *Coxal plates* divided by deep and distinct grooves on every thoracic somite in both sexes. *Abdomen* not abruptly contracted, with prominent oblique carinæ on each side of 3rd, 4th, and 5th somites. *Telson* arcuate; postero-lateral processes acute, produced as far as or beyond middle of hind border; accessory processes not produced, but the inner forms a prominent undulation. *Telson* twice as broad as long. *Mouth-parts* as in *L. oceanica*. 1st, 2nd, and 3rd *peræopods* with carpus and merus expanded as in *oceanica*. 2nd and 3rd legs with small process on propodus not reaching beyond the dactyl in both sexes. *Uropods* 8 mm.

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Distribution. Litycha; Alaska.; California; British Columbia. (See Richardson (1905) for complete list.)

Figures in Richardson (1905).

This species is nearly related to the foregoing.

3. *LIGIA GLABRATA* Brandt. (Pl. I. fig. 5; Pl. II. fig. 6.)

Ligia glabrata Budde-Lund (1885), p. 263.

?*Ligia dilatata* Collinge (1920), p. 475.

Female specimen described.

Length 13 mm. *Breadth* 6 mm. (Another imperfect specimen measured 19 mm. by 9 mm.)

Surface very slightly granulated or nearly smooth. *Eyes* of small size, separated by about one and one-half times their horizontal length. *Antennæ* of moderate length; flagellum reaching as far back as hind border of 5th thoracic somite, peduncle to hind border of 2nd segment; flagellum with 15 to 17 slightly setose, short, and squat segments. The *coxal plates* are divided by deep grooves on the 2nd, 3rd, and 4th thoracic somites. *Abdomen* not abruptly contracted. *Telson* arcuate; postero-lateral processes blunt and little produced; accessory processes almost obsolete. *Mouth-parts*: 2nd maxilla not bilobed, though a crease indicates the usual division; without hairy bristles on inner side. Maxillipede with 1st and 5th joints of palp distinct; remainder only indicated by deep marginal indentations. *Pereopods* typical in form. *Uropods* 4.5 mm.

Distribution. Cape of Good Hope; Table Bay.

Collinge (1920) surmises that *L. glabrata* is possibly an immature form of *L. dilatata*. These specimens are, however, undoubtedly mature, and must be identified with the former of Brandt's species. I have seen no male of this species.

4. *LIGIA OCCIDENTALIS* Dana. (Pl. II. figs. 7 & 8.)

Ligyda occidentalis Richardson (1905), p. 681 (*q. v.* for synonymy).

Male specimen described.

Length 25 mm. *Breadth* 11 mm.

Surface minutely granulated. *Eyes* large and quadrangular, and separated by less than the horizontal length of one eye. *Antennæ* moderately long and slender; flagellum reaching as far back as hind border of 6th thoracic somite, peduncle to hind border of 2nd. Flagellum with 22 long and slender segments. Division of *coxal plates* lightly marked on all thoracic somites. *Abdomen* not abruptly contracted. *Telson* very obtusely triangulate; postero-lateral processes are as long as or longer than median process; accessory processes very small. *Mouth-parts*: 2nd maxilla weakly bilobed, with no hairy bristles; maxillipede with five distinctly marked joints. Propodus of 1st *pereopod* with prominent process on inner side of distal end, which projects forwards by the side of the dactyl. Carpus and merus of 1st and

2nd legs and carpus of 3rd flattened and striated as in *oceanica*.
Uropods 10 mm.

Distribution. California; San Francisco. (See Richardson (1905) for complete list.)

Figures in Richardson (1905).

5. *LIGIA CINERASCENS* Budde-Lund. (Pl. II. fig. 9.)

Ligia cinerascens Budde-Lund (1885), p. 265.

Ligyda cinerascens Richardson (1909), p. 126.

Male specimen described.

Length 27 mm. *Breadth* 12 mm.

Surface minutely granular, rather smooth. *Eyes* large and nearly round, separated by their horizontal length or a little less. *Antennae* moderately long and stout; flagellum reaching as far back as half-way across the 6th somite; the peduncle half-way across the 2nd; flagellum with 25 short and stout segments. *Coxal plates* faintly indicated on all the thoracic somites of the male and very distinctly in the female. *Abdomen* not abruptly contracted. *Telson* broadly triangulate, the median process obtuse; postero-lateral processes produced to acute points reaching no further backwards than inner accessory processes; accessory processes slight but sharp. *Mouth-parts*: 2nd maxilla strongly bilobed, with two small hairy bristles on inner side; maxillipede with the five joints entirely separate. First *perceopod* with prominent inner process on propodus in male. *Uropods* 10 mm. + (rami broken).

Distribution. Hakodate, Japan; Manila or Chile.

This species is nearly related to *L. occidentalis*, but differs from it in the telson and the character of the antennæ. The segments of these are more numerous in *L. cinerascens*, but short and squat so that the whole appendage is relatively shorter than in *L. occidentalis*.

6. *LIGIA EXOTICA* Roux. (Pl. II. fig. 10.)

Ligia dentipes Budde-Lund (1885), p. 268.

?*Ligia malleata* Pfeffer (1889), p. 36.

Ligia exotica Budde-Lund (1908b), p. 303.

Ligyda exotica Richardson (1905), p. 676 (*q. v.* for complete synonymy).

Ligyda exotica Richardson (1909), p. 125.

Ligia exotica Budde-Lund (1912), p. 391.

Ligia exotica Chilton (1916), p. 462.

Male specimen described.

Length 27 mm. *Breadth* 17 mm.

Surface moderately roughly granulate. *Eyes* large and separated by less than their horizontal length. *Antennæ* very long and slender; flagellum reaching as far back as hind border of 5th abdominal somite, peduncle to hind border of 3rd thoracic somite. Flagellum with 28 or more very long and slender segments. The

antenna is shorter in the female. The whole is as long as the thorax, and the peduncle reaches half-way across the 3rd somite. *Coxal plates* distinctly marked on all segments in both sexes. *Abdomen* not abruptly contracted. *Telson* with acute median process; postero-lateral processes drawn out to equal or exceed the median in length; accessory processes long and acute. *Mouth-parts*: 2nd maxilla bilobed, but without hairy bristles on inner side. Maxillipede with five joints of palp not clearly divided. First *peræopod* with prominent inner process on propodus in male. I find the first three legs of the male to have similar expansions on the carpus and merus to the 1st leg of *L. oceanica*, but Chilton does not mention the point, so it may not be universal or present at all seasons of the year. *Uropods* 17.5 mm.

Distribution. "Widely distributed on the warmer shores of the Atlantic, Pacific, and Indian Oceans, and it has been recorded on the American coast as far south as Chili and Puntarenas" (Chilton (1906)). Budde-Lund's specimens are as follows:—Aden; Bagamoja, Shellah-Lama, E. Africa; Bissao; Brazil; Colombo; Malacca; Nagasaki; Rio de Janeiro; Singapore; Pulo Milo, Touga (Malay Archipelago). (See Richardson (1905) for further list.)

Budde-Lund describes under the name *L. dentipes* a species to which he gives no character that distinguishes it from *exotica*. A careful examination of his specimen reveals no cause why this species should be any longer separated from *L. exotica*.

Figured and described in detail by Chilton (1906).

7. *LIGIA OLFERSII* Brandt.

Ligyda olfersii Richardson (1905), p. 674 (*q. v.* for synonymy).

Female specimen described, owing to mutilated condition of the males in my possession.

Length 19 mm. *Breadth* 9 mm.

Surface minutely granular, rather smooth. *Eyes* of narrow-oblong shape, separated by less than their horizontal length. *Antennæ* long and slender; flagellum reaching as far back as hind margin of thorax, peduncle to hind margin of 2nd thoracic somite. Flagellum with 26 (broken) long and narrow segments. *Coxal plates* divided by deep grooves on 2nd, 3rd, and 4th thoracic somites. In the male there is no indication of the line of fusion. *Abdomen* not abruptly contracted. *Telson* broadly triangulate; postero-lateral processes acute, but not longer than inner accessory processes; accessory processes strongly marked. *Mouth-parts*: 2nd maxilla weakly bilobed, without hairy bristles; maxillipede, five divisions only indicated on margin and not going right across the palp. *Peræopods* of female typical in form. In the male the carpus and merus of the 1st and 2nd are deeply excavated on the inner side. *Uropods* 11 mm.

Distribution. St. Thomas, Trinidad; Florida; Brazil.
Figures in Richardson (1905).

8. *LIGIA ITALICA* Fabricius. (Pl. II. figs. 11 & 12.)

Ligia italica Budde-Lund (1885), p. 269 (q. v. for synonymy).

Ligia italica Budde-Lund (1908 a), p. 11.

Male specimen described.

Length 8.5 mm. *Breadth* 3.5 mm.

Surface nearly smooth; scattered minute granules. *Eyes* of moderate size, somewhat rectangular and separated by horizontal length of one eye or a little less. *Antennae* long and slender; flagellum reaching as far as hind border of 6th thoracic somite, peduncle to the 2nd. Flagellum with 18-20 long and slender segments. *Coxal plates* either exceedingly faintly separated or the division is apparently obsolete. In the female the separation is marked, but not very distinctly, on the 2nd, 3rd, and 4th thoracic somites. They are but little produced backwards on any somite. *Abdomen* abruptly contracted; lateral margins of somites only very slightly produced backwards. *Telson* arcuate; postero-lateral processes obsolete; only slight undulations mark the accessory processes. *Mouth-parts*: 2nd maxilla strongly bilobed, without hairy bristles; maxillipede with five joints indistinctly separated. *Perceopods* typical in form. *Uropods* 4 mm.

Distribution. "A common species on the sea-shore in almost all the countries adjacent to the Mediterranean Sea, also found in the Madeira and Canary Islands" (Budde-Lund (1908 a)).

I agree with Budde-Lund in looking upon Brandt's *ehrenbergii* as a synonym, but, also with him, I am doubtful of the identity of the specimen described by Dana under that name (1852). The matter is further discussed under *L. gracilipes*.

9. *LIGIA GRACILIPES* Budde-Lund. (Pl. II. figs. 13, 14, & 15.)

Ligia gracilipes Budde-Lund (1885), p. 270.

?*Ligia ehrenbergii* Dana (1852), p. 738.

?*Ligia dilatata* Collinge (1920), p. 475.

The somewhat macerated condition of the specimens makes it impossible to give a complete description of any one. The following account applies to the female, and as I cannot be positive that any of the specimens were males, I have not referred to the characters of that sex.

Length 7 mm. *Breadth* 3.5 mm.

Surface minutely granulated. *Eyes* large and separated by less than their horizontal length. *Antennae* extraordinarily long and slender. Whole appendage one-quarter as long again as thorax and abdomen together; peduncle reaching as far back as hind border of penultimate *abdominal* somite. Flagellum with 22 (Budde-Lund) very long and slender segments. (A separate antenna had 28 segments; each segment was about five times as long as broad.) *Coxal plates* separated by deep grooves on 2nd, 3rd, and 4th thoracic somites, and distinctly marked on the 5th. *Abdomen* abruptly contracted. *Telson* arcuate; the postero-lateral

processes blunt and but little produced; accessory processes almost obsolete. *Mouth-parts*: 2nd maxilla without any trace of division into two lobes; without hairy bristles on inner side. Maxillipede indistinctly divided into five segments. *Peraopods* very slender, but otherwise typical in form. The *Uropods* were not attached to any specimen, but a separate appendage was 12 mm. in length, the base being 3 mm. and the rami exceedingly long and slender. They are stated by Budde-Lund to be longer than the body.

Distribution. S. Africa, "e 'Laudana' exempla pauca in museo Simon asservantur" (Budde-Lund).

Although the material from which this species was made is poor, there is no doubt, I think, that it is a good one. Collinge, (1920), who had only Budde-Lund's short description to guide him, discussing the point, suggests that it is a "young form of some species," admitting, however, that young specimens have, as a rule short antennæ, whereas the *gracilipes* is notable for the great length of the antennæ. He seems to overlook the quite extraordinary length of the uropods. Dana (1852) identified provisionally as *L. ehrenbergii* Brandt, specimens found at Madeira. His description and figures of these specimens apply to *L. gracilipes* in every particular but size and locality. The size he gives as between 17 mm. to 19 mm. long, and 7 mm. to 8 mm. broad—more than double the dimensions of Budde-Lund's specimens. The locality is N.W. Africa as against S. Africa of the *gracilipes*. It seems as if Dana would have been justified in creating a new species for the reception of the specimens, but as he did not do so, they must be identified with *L. gracilipes* if further material should prove them to be the same. I do not think they should be so identified in the present state of our knowledge.

10. *LIGIA HAWAIIENSIS* Dana. (Pl. II. fig. 16.)

Ligia hawaiiensis Dana (1852), p. 740.

Ligia hawaiiensis Budde-Lund (1885), p. 271.

Ligia vitiensis Stebbing (1900), p. 646.

Male specimen described.

Length 19.5 mm. *Breadth* 7.5 mm.

Surface minutely granular. *Eyes* large and quadrangular and separated by less than their horizontal length. *Antennæ* very long and slender; flagellum reaching as far back as hind border of 3rd abdominal somite; peduncle half-way across 3rd thoracic somite; flagellum with 30 long segments, each about twice as long as it is broad. The antennæ in the female reach to the hind border of the thorax, and the flagellum has about 26 segments. *Coxal plates* scarcely, if at all, separated. In the female, deep grooves mark the distinction on the 2nd and 3rd thoracic somites, but indications are absent or exceedingly faint on other somites. *Abdomen* abruptly contracted. *Telson* triangulate; median process

well marked; postero-lateral processes acute but short; accessory processes well marked. *Mouth-parts*: 2nd maxillæ weakly lobed, without hairy bristles on inner side; maxillipede with palp deeply lobed on margin into five portions, but segments otherwise indistinctly marked. First *peræopod* with prominent inner process on propodus in male only. Expansions similar to those of *oceanica* on carpus and merus of this leg. *Uropods* (separate) 7.5 mm.

Distribution. Hawaiian Islands; Molokai; Matadona, China Straits, British New Guinea.

I have examined the specimens of the Willey Collection labelled *L. vitiensis*, and identify them, without possible doubt, as this species.

Figured by Dana (1852).

11. LIGIA NOVÆ-ZEALANDIÆ Dana.

Ligia novi-zealandiæ Dana (1852), p. 739.

Ligia cursor Budde-Lund (1885), p. 265.

Ligia novæ-zealandiæ Chilton (1901), p. 106 (*q. v.* for complete synonymy).

Ligia novæ-zealandiæ Chilton (1909), p. 287.

Ligia novæ-zealandiæ Chilton (1911), p. 568.

Male specimen described.

Length 12 mm. *Breadth* 5.5 mm.

Surface minutely granular. *Eyes* rather small and quadrangular, and separated by twice their horizontal length. *Antennæ* very long and slender; flagellum reaching as far back as hind border of 4th abdominal somite; peduncle to hind border of 3rd thoracic somite. Flagellum with 20 small and setose segments. The antennæ are shorter in the female. The whole is as long as the thorax, and the peduncle reaches half-way across the 3rd somite. The segments of the flagellum are more setose than in the male. *Coxal plates* very faintly marked or absent. In the female they are marked by deep grooves on the 2nd, 3rd, and 4th thoracic somites. *Abdomen* abruptly contracted. *Telson* arcuate; postero-lateral processes acute and produced, but shorter than middle of hind border; accessory processes marked by slight undulations. *Mouth-parts*: 2nd maxilla with no trace of division into two lobes; without hairy bristles on inner side. *Maxillipede* with 1st and 5th joints only, completely separated, remainder only indicated by indentations on inner side. 1st and 2nd *peræopods* with carpus much swollen in male only; subchelate. *Uropods* 5 mm.

Distribution. Coast of New Zealand; Steward Island; Sunday Island, Victoria; Chile; Juan Fernandez.

I found that Budde-Lund's specimens, labelled *Ligia cursor*, from Juan Fernandez (and described by him under that name (1885)) agreed in every particular but length of antennæ with Chilton's description (1901) of *L. novæ-zealandiæ*. These

specimens were all females. An examination of Chilton's original specimens of *novæ-zealandiæ* showed that the antennæ were shorter in the female than in the male, and that the females agreed entirely with Budde-Lund's *cursor*. Fragments of a specimen, labelled "*L. cursor* (male)," from Chile, in Budde-Lund's collection, proved to have subchelate 1st legs like those of the male of the *novæ-zealandiæ*. The *cursor* described by Budde-Lund is therefore synonymous with Dana's *novæ-zealandiæ*.

Dana's original account of *L. cursor* (1852) figures and describes the telson as triangulate. Budde-Lund was misled by the locality of his specimens into crediting Dana with an error on that point, and hence gave a description of *L. novæ-zealandiæ* from S. America (specimens of which he thought he had not seen) under the name of *L. cursor*. The latter species has not apparently been found since Dana described it from "Valparaiso."

The matter is of considerable interest, as Chilton has already had occasion to observe (1909 a & 1915) the similarity of fauna of South America and New Zealand in connection with other terrestrial and aquatic forms.

Figured and described in detail by Chilton (1901).

12. *LIGIA BAUDINIANA* Milne-Edwards. (Pl. II. figs. 17 & 18.)

Ligyda baudiniana Richardson (1905), p. 678 (*q. v.* for synonymy).

Male specimen described.

Length 20 mm. *Breadth* 9 mm.

Surface rather coarsely granular. *Eyes* large and separated by less than their horizontal length. *Antennæ* long and slender; flagellum reaching as far back as hind border of last thoracic somite, peduncle to hind border of 2nd. Antennæ slightly shorter in the female. Flagellum with 29 small and slender segments. *Coxal plates* very faintly marked on 2nd, 3rd, and 4th thoracic somites. In the female they are very distinct on the corresponding somites. *Abdomen* not abruptly contracted. *Telson* triangulate; median process bluntly rounded; posterolateral processes acute, but not projecting as far back as median process; accessory processes represented by undulations. *Mouth-parts*: 2nd maxilla bilobed, but without hairy bristles on inner side. Maxillipede palp with five distinctly separate segments. Propodus and carpus of 1st peraeopod (in male only) each produced on inner side to a flat plate-like expansion; free borders each fringed with a comb of exceptionally long and markedly equal setæ. The plates are obliquely striated. *Uropods* (separate) 12.5 mm. The uropods on the female specimens were shorter in proportion than these, which possibly, however, did not belong to the specimen described above. (In an 18 mm. female the uropods measured 8.5 mm.)

Distribution. Bermudas; Mexico; Yucatan; the Bahamas; Progreso, Colon.

Budde-Lund (1885), without having seen a specimen, regarded this species as a synonym of *L. exotica*. The features which distinguish it from *L. exotica* were fully pointed out by Richardson (1902), with additional evidence for its separation from that species. Chilton (1916), who had not seen a specimen, remarks that it "may be difficult to find characters that will distinguish between them in all cases."

Among Budde-Lund's material, I found a tube bearing a name of an undescribed species of *Ligia* which he evidently intended to describe in the course of his revision of 'Isopoda Terrestria.' An examination of the specimens showed at once that they were identical with Milne-Edwards's *baudiniana*, which had obviously been overlooked by Budde-Lund. This furnishes a further proof of the complete independence of this species from the *exotica*, as upheld by Richardson.

Figures in Richardson (1905).

13. *LIGIA PIGMENTATA*, sp. n. (Pl. I. figs. 2 & 3.)

The material consisted of a single female specimen and a few appendages which may have belonged to a male.

Length 14 mm. *Breadth* 5 mm.

Surface slightly granulated, nearly smooth. *Colour* cream, with scattered minute black spots. *Eyes* large, quadrangular and separated by their horizontal length. *Antennæ* of moderate length; flagellum reaching as far back as half-way across 5th thoracic somite, peduncle half-way across 2nd somite. Flagellum with 18 short and broad segments. *Coxal plates* with suture lines exceedingly lightly marked on 2nd, 3rd, and 4th thoracic somites only. They are produced but little backwards on any somite. *Abdomen* not abruptly contracted. *Telson* triangulate; median process bluntly pointed; postero-lateral processes acute but short; inner accessory processes small and blunt. *Mouth-parts*: 2nd maxilla strongly bilobed; without hairy bristles on inner edge. *Maxillipede* palp with joints completely separated. *Perceopods* typical in form. A separate one (male?) had a thick bunch of setæ on the dactyl, over the unguis. *Uropods* 6 mm. Base 2.5 mm., rami 3.5 mm.

Distribution. Suez.

Budde-Lund had labelled the tube containing this specimen with the above specific name, but had apparently published no description or figures of it.

14. *LIGIA PERKINSI* (Dollfus). (Pl. I. fig. 1.)

Geoligia perkinsi Dollfus (1900), p. 525.

Male specimen described.

Length 18 mm. *Breadth* 8 mm.

Surface almost smooth. *Eyes* large and separated by their horizontal length or a little less. *Antennæ* very long and slender:

flagellum reaching as far back as hind border of 4th abdominal somite; peduncle half-way across 3rd thoracic somite. Flagellum with 30 very long and slender segments. *Coxal plates* show no sign of division from terga, but in the female the sutures are strongly marked on the 2nd, 3rd, and 4th thoracic somites. Hinder thoracic somites and free abdominal somites with postero-lateral angles much drawn backwards and very acute. *Abdomen* not abruptly contracted. *Telson* triangulate; median process blunt; postero-lateral processes acute and drawn out, but not as far back as inner accessory processes. Both accessory processes represented by undulations. *Mouth-parts*: 2nd maxilla weakly bilobed and without hairy bristles. Maxillipede with five separate joints to the palp. *Percopods* typical in form. *Uropods* 14 mm.

Distribution. Hawaiian Islands, Karrai 6000 ft., Oloa 2000 ft.

Although this species is apparently purely terrestrial, it shows no modification whatever from the typical littoral Ligiidæ. The reasons for removing it from Dollfus's genus are given in the beginning of this paper.

15. *LIGIA NATALENSIS* Collinge.

Ligia natalensis Collinge (1920), p. 474.

Male specimen described.

Length 10 mm. *Breadth* 4·5 mm.

Surface minutely granular, rather smooth. *Eyes* moderately large and separated by their horizontal length. *Antennæ* exceedingly long and slender; whole appendage longer than body in male, and as long as body in female; peduncle reaching as far as hind border of 4th thoracic somite in male, and half-way across that somite in female. The flagellum has 20-23 long, slender, and distinctly setose segments. *Coxal plates* show no sign of division from terga, but are faintly marked on 2nd, 3rd, and 4th thoracic somites of female. *Abdomen* abruptly contracted. *Telson* arcuate; postero-lateral processes only very slightly produced; the accessory processes obsolete. *Mouth-parts*: 2nd maxilla not divided into two lobes, without hairy bristles on inner side. Maxillipede with 1st and 5th joints of palp separated; remainder only indicated by deep marginal indentations. *Percopods* slender, but of typical form. *Uropods*: No specimens of this size had uropods attached. In a male specimen 7 mm. in length they measured 4 mm.; a female 10·5 mm. had uropods of 4 mm.

Distribution. Umklali, Winkle Spruit Beach, South Coast, Natal.

This species is nearly related to *L. gracilipes*, but is distinguished from it by the more massive form of body and appendages and the smaller uropods. I am unable to confirm Collinge's observation that the flagella of the antennæ of 7 to 9 mm. specimens of *natalensis* have fewer joints than those of *gracilipes*. In most cases, specimens of that size were as mature in form as larger specimens.

Figured and described by Collinge (1920).

I have not seen specimens of the following species:—

16. *LIGIA DILATATA* Brandt.

Ligia dilatata Brandt (1833), p. 171.

Lygia dilatata Krauss, Südafrik. Crust., 1843, p. 62.

Ligia dilatata White, List Crust. Brit. Mus. 1847, p. 98.

Ligia dilatata Budde-Lund (1885), p. 262.

Ligia dilatata Stebbing, Ann. South African Mus. 1910, vi.
p. 437.

Ligia dilatata Collinge (1920), p. 475.

Distribution. Cape Peninsula.

Collinge has re-described and figured this species in the last-named work, but has added little to Budde-Lund's previous description. Reasons for regarding *L. glabrata* and *L. gracilipes* as independent species and not as shown in Collinge's synonymy are given above.

17. *LIGIA RICHARDSONÆ* (Pearse).

Ligyda richardsonæ Pearse (1915), p. 549.

Distribution. Sierra Nevada de Santa Marta, Colombia, at 3800 ft. elevation.

Fully described and figured by Pearse.

18. *LIGIA SIMONI* (Dollfus).

Geoligia simoni Dollfus (1893), p. 343.

Distribution. Valencia, "vers 1200 mètres d'altitude, dans les forêts."

This species only appears to differ from the preceding in the greater relative breadth of the body and the larger size of the eyes. Dollfus's description is based on a single male specimen, however, and occurring as they do so close together, it is probable that collection of further material will show them to be identical.

Figured and briefly described by Dollfus.

The following species are insufficiently described or of doubtful validity:—

19. *LIGIA CAJENNENSIS* Koch (1847).

20. *LIGIA AUSTRALIENSIS* Dana (1852).

21. *LIGIA CURSOR* Dana (1852).

22. *LIGIA VITIENSIS* Dana (1852).

23. *LIGIA MALLEATA* Pfeffer (1889).

Distribution Bagamoyo.

The description of this species and the locality in which it was found suggests its identity with *Ligia exotica*. Pfeffer does not, however, mention the character of the 1st leg nor the sex of the

species he described. If it was a male it differs from *L. exotica* in the absence of a process on the propodus, but if a female it is probably synonymous with *L. exotica*.

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EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. Dorsal view of *Ligia perkinsi*. $\times 5$.
 2. " " *L. pigmentata*, sp. n. $\times 5$.
 3. Telson of *L. pigmentata*, sp. n. $\times 13.5$.
 4. *L. pallasii*. 2nd leg of male. $\times 5$.
 5. *L. glabrata*. Telson and uropods. $\times 7.7$.

PLATE II.

- Fig. 6. *Ligia glabrata*. Antenna. $\times 9$.
 7. *L. occidentalis*. Telson. $\times 7$.
 8. " " Antenna. $\times 6$.
 9. *L. cinerascens*. Antenna. $\times 5$.
 10. *L. exotica*. Telson. $\times 10$.
 11. *L. italica*. Antenna. $\times 7$.
 12. " " Telson. $\times 16$.
 13. *L. gracilipes*. Antenna. $\times 7.7$.
 14. " " Uropod. $\times 7$.
 15. " " Telson. $\times 17$.
 16. *L. hawaiiensis*. Telson. $\times 13$.
 17. *L. baudiniana*. Telson. $\times 11$.
 18. " " 1st leg of male. $\times 9$.