

11. Notes on Marine Wood-boring Animals.—II. Crustacea.

By W. T. CALMAN, D.Sc.

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The Crustacea collected for the Committee of the Institution of Civil Engineers include, besides species already known to bore into wood, a number of others, the presence of which in the damaged timber is probably accidental. The possibility, however, that some of these also may prove to be destructive makes it desirable to record their names. The actual wood-boring species in the collection are all well-known, and little of importance is added to our knowledge of their distribution, but the opportunity has been taken to confirm, by direct comparison, the suggested identity of the Indo-Pacific *Sphæroma terebrans* with the Atlantic *S. destructor*.

As in the case of the Teredinidæ, the occurrence of European species of wood-boring Crustacea (*Limnoria* and *Chelura*) in Australia and New Zealand has been attributed to introduction by wooden ships. It is true that neither of them, so far as I know, has been recorded as living in ships' timbers, but their appearance in widely-separated localities, while distinct species of the same genera occur at intermediate points (*e. g.*, at Christmas Island, Calman, Ann. Mag. Nat. Hist. (8) v. 1910, p. 181), is suggestive of some such means of transport.

Order ISOPODA.

Sub-order FLABELLIFERA.

SPHÆROMA TEREBRANS Spence Bate.

S. terebrans Spence Bate, Ann. Mag. Nat. Hist. (3) xvii. 1866, p. 28, pl. ii. fig. 5; Stebbing, Spolia Zeylanica, ii. 1904, p. 16, pl. iv.; Hansen, Q. J. Micr. Sci. xlix. 1905, p. 116; Stebbing, Ann. S. Afric. Mus. vi. 1908, p. 49; Chilton, N.Z. Journ. Sci. Technol. ii. 1919, p. 12; Calman, Marine Boring Animals, Brit. Mus. (Nat. Hist.) Economic Ser. No. 10, 1919, p. 21, fig. 11; *id.*, Committee on Structures in Sea-water, Inst. Civ. Engineers, 1st Rep. 1920, p. 70, pl. i. fig. 5; Barnard, Ann. S. Afric. Mus. xvii. 1920, p. 358.

S. vastator Spence Bate, Ann. Mag. Nat. Hist. (3) xvii. 1866, p. 28, pl. ii. fig. 4.

S. destructor Richardson, Proc. Biol. Soc. Washington, xi. 1897, p. 105, text-figs.; *id.*, Amer. Nat. xxxiv. 1900, p. 223; *id.*, Proc. U.S. Nat. Mus. xxiii. 1901, p. 534; *id.*, Bull. U.S. Nat. Mus. liv. 1905, p. 282, text-figs.

Locality.—Brisbane, Queensland. Specimens forwarded by Mr. E. A. Cullen, Engineer for Harbours and Rivers. From

Jetties, 5 miles from river entrance in Moreton Bay, in Swamp Mahogany (*Tristania suaveolens*) and Ironbark (*Eucalyptus paniculata*). Many specimens.

Specimens are in the Museum collection from Wyong River, New South Wales, and Brisbane (Prof. Chilton), Travancore (Trivandrum Mus.), Isipingo River, Natal (Durban Mus.), and St. John's River, Palatka, Florida (U.S. Nat. Mus., syntypes of *S. destructor* Richardson).

Remarks.—This species has already been recorded from Brisbane by Prof. Chilton.

Barnard has recently adduced further evidence in favour of Stebbing's view, disputed by Miss Richardson, that the Indo-Pacific species is identical with *S. destructor* Richardson, from Florida. No one, however, has hitherto been able to base this identification on a direct comparison of specimens. By the courtesy of the authorities of the U.S. National Museum, who have presented syntypes of *S. destructor* to the British Museum (Nat. Hist.), I have been able to compare these with specimens from all the other localities mentioned above. I have failed to find any difference that can be regarded as specific. Both Stebbing and Barnard have indicated a certain amount of variation in the tubercles and ridges of the dorsal surface, and this is shown more conspicuously by the specimens now examined. The specimens from Brisbane grow to a greater size (11.5 mm. total length) than the syntypes, and have the tubercles on the sixth and seventh peræon-segments very low; the submedian tubercles on the telsonic segment are distinctly elongated in an antero-posterior direction, and the granulation of the telsonic segment is less close than in the syntypes. The Travancore specimens agree better with the syntypes in their smaller size, generally more prominent tubercles, and closer granulation of the telson, but they differ in having the submedian tubercles of the telson distinctly smaller than those of the lateral pair. The Natal specimen bears a close resemblance to those from Brisbane. I have only been able to observe one character in which the Indo-Pacific specimens agree with one another, while differing from the syntypes. Seven specimens from Wyong River, Brisbane, Travancore, and Natal were found, on dissection, to agree with Stebbing's account in having three large setæ and a small one on the inner plate of the maxillula. Miss Richardson found in her specimens "five strong plumose setæ and occasionally a sixth one that is feeble." The single syntype that I have dissected has five large setæ and a small one on the maxillula of one side, but on its fellow there are six setæ of equal size. In none of the other characters mentioned by Miss Richardson is there any constant difference to be detected*.

* *S. peruvianum* Richardson (Proc. U.S. Nat. Mus. xxxviii. 1910, p. 81, text-figs. 3 and 4), found boring in the roots and stems of mangroves on the coast of Peru, is very similar to the species here discussed, but the broadly-rounded terminal segment, the longer antennules and antennæ, and other characters indicated by Miss Richardson may justify its separation. I have seen no specimens.

Hansen has already stated that this species is to be included in the genus *Sphaeroma* as restricted by him. Ovigerous females in the Brisbane collection agree with his definition of the genus in having large overlapping oostegites, while the eggs (and embryos) are contained in internal pouches opening by four pairs of large slits on the sternal surface, as in *S. rugicauda* and *S. serratum*.

A large number (well over a score) of males have been examined, which, from their size (up to 9.5 mm. in length), from the fact that they were found in the same gathering with ovigerous females and from the presence on the last thoracic sternite of a pair of penes, would ordinarily be regarded as adults. Two individuals were dissected and found to have the *vasa deferentia* distended with bundles of filiform spermatozoa. Nevertheless, in no case was there a trace of an *appendix masculina* or even of a marginal thickening on the second pleopods*. Hansen states (op. cit. p. 88) that an *appendix masculina* is present in adult males of all the genera of Sphaeromidae except *Dynamene* and *Ancinella*, but he notes that in the subfamily *Sphaerominae* it "does not appear before the animals are nearly full-grown," while the penes are present at a much earlier stage. His account of *Cymodoce pilosa* (op. cit. p. 89) suggests caution in deciding as to the sexual maturity even of large individuals. Nevertheless, the conclusion seems to be justified that the *appendix masculina* is not developed in *Sphaeroma terebrans*, which in this respect forms an exception among the species of the genus.

Crustacea associated with S. terebrans.—Stebbing has recorded the occurrence of the little Asellotan *Iais pubescens* in association with *S. terebrans* at Ceylon. He had previously given an extended description, with figures, from specimens taken on *Exosphaeroma gigas* at the Falkland Islands (Proc. Zool. Soc. 1900, p. 549, pl. xxxviii.). The collection of *S. terebrans* from Brisbane includes numerous specimens, and that from Natal a solitary young specimen of what is probably the same species. Some of the Brisbane specimens carrying eggs do not exceed 2.24 mm. in length (Stebbing's Falkland specimens reached 2.5 mm.). They have not more than 13–14 segments in the flagellum of the antenna, the uropods are nearly half as long as the abdomen, and the exopod of the uropods is much longer than the peduncle and definitely longer than the endopod.

Specimens found on *Exosphaeroma gigas* from the Auckland Islands differ from these and agree with Stebbing's Falkland Island specimens in having more numerous segments in the flagellum of the antenna (22, while Stebbing records "attaining to 25"), the uropods not more than one-third as long as the telsonic segment, and the exopod of the uropods equal to the

* Barnard notes the absence of the *appendix masculina* in the single male (9 mm. in length) examined by him.

peduncle and shorter than the endopod. The distal segments of the antennules are a good deal less slender than in the Brisbane specimens.

I am unable to perceive any other differences of importance, and, while it might be considered that those enumerated would justify giving a new varietal or even specific name to the Brisbane specimens, I prefer to await further evidence from other localities regarding the range of variation in this widely-distributed species.

Among the Brisbane specimens of *Sphæroma terebrans* were numbers of another Sphæromid, apparently belonging to the genus *Exosphæroma*, but differing from all the described species of that genus. There seems to be no reason for suspecting this species of complicity in the destruction of the timber. The body is more depressed than one would expect to find it in a burrowing animal, and the mouth-parts are much less prominent than they are in *Sphæroma terebrans*.

Somewhat more suspicious is the case of an Isopod of which a collection was sent from H.M. Dockyard, Simon's Town, by Lieut. L. H. A. Shadwell, R.N.V.R. The specimens were from "Greenheart camber piles, W. yard," and were labelled as *Sphæroma*. They proved to belong to the species *Parisocladus stimpsoni* (Heller), agreeing closely with Barnard's description and figures (Ann. S. Afric. Mus. x. 1914, p. 399, pl. xxxii. G), and being of the smaller size (male about 7.5 mm. long) which he mentions as characteristic of specimens from the east side of the Cape Peninsula. Here, again, the general form of the body and the disposition of the mouth-parts are not such as to suggest a boring habit. On the other hand, the timber in question must have been attacked by some boring animal, and if *Sphæroma terebrans* had been present in numbers sufficient to cause visible damage it could hardly have been entirely overlooked by the collector.

The only other animals in this gathering were two specimens of *Cirolana sulcata*. Like its congeners, this species is no doubt predatory and not at all likely to attack wood.

LIMNORIA LIGNORUM (Rathke).

Cymothoa lignorum Rathke, Skrivt. Naturh. Selsk. Kjøbenhavn, v. (1) 1799, p. 101, pl. iii. fig. 14 a-d.

Limnoria terebrans Leach, Edinburgh Encyc. vii. 1814, p. 433; Coldstream, Edinburgh New Philos. Journ. xvi. 1834, p. 316, pl. vi.

Limnoria lignorum White, Pop. Hist. Brit. Crust. 1857, p. 227, pl. xii. fig. 5; Spence Bate and Westwood, Brit. Sessile-eyed Crust. ii. 1868, p. 351, figs.; Harger, Rep. U.S. Comm. Fish. vi. 1880, p. 373, pl. ix. figs. 55-57; Hoek, Verh. K. Akad. Wet. Amsterdam (Tweede Sectie), i. No. 6, 1893, 103 pp., 7 pls.; Sars, Crust. Norway, ii. 1897, p. 76, pl. xxxi.; Chilton, Ann. Mag. Nat. Hist. (8) xiii. 1914, pp. 380 & 448; *id.*, N.Z. Journ. Sci. Technol. ii. 1919, p. 3, figs.; Calman, Marine Boring Animals, Brit. Mus.

(Nat. Hist.) Economic Ser. No. 10, 1919, p. 17; *id.*, Committee on Structures in Sea-water, Inst. Civ. Engineers, 1st Rep. 1920, p. 68, pl. i. fig. 4.

Localities.—Leith. Specimens forwarded by J. Dalgleish Easton, Deputy Superintendent, Port of Leith. From Jetties, in White Pine and Pitch Pine. Many specimens.

Southampton. Specimens forwarded by F. E. Wentworth Shields, Docks Engineer, L. & S.W. Railway. From Outer Dock, in American Elm. Few specimens.

Simon's Town, Cape of Good Hope. Specimens forwarded by Lieut. L. H. A. Shadwell, R.N.V.R., Officer in charge of works, H.M. Dockyard. From creosoted Danzig timber, No. 3 slip. Few specimens.

Auckland, New Zealand. Specimens forwarded by Mr. W. H. Hamer, Engineer to the Auckland Harbour Board. From Totara timber. Many specimens.

Remarks.—As the European *L. lignorum* has already been recorded from S. Africa (Port Elizabeth) and Auckland, the records given above do not extend its known range.

In stating that "in Europe . . . *Limnoria lignorum* seems to be constantly associated with *Chelura terebrans*" Chilton (*l. c.* 1919, p. 6) is repeating a statement frequently made, but certainly erroneous. At Leith, and elsewhere on the east coast of Scotland and England, while *Limnoria* is abundant, there seems to be no record of *Chelura*.

Order AMPHIPODA.

Suborder GAMMARIDEA.

CHELURA TEREBRANS Philippi.

C. terebrans Philippi, Arch. Naturgesch. li. 1839, p. 120, pl. iii. fig. 5; Stebbing, Das Tierreich, xxi., Gammaridea, 1906, p. 693 (with references); Chilton, Ann. Mag. Nat. Hist. (8) xiii. 1914, p. 380; *id.*, N.Z. Journ. Sci. Technol. ii. 1919, p. 6. fig.; Calman, Marine Boring Animals, Brit. Mus. (Nat. Hist.) Economic Ser. No. 10, 1919, p. 20; *id.*, Committee on Structures in Sea-water, Inst. Civ. Engineers, 1st Rep. 1920, p. 71, pl. i. fig. 6.

Localities.—Southampton. Specimens forwarded by F. E. Wentworth Shields, Docks Engineer, L. & S.W. Railway. From Outer Dock, in American Elm. Few specimens.

Simon's Town, Cape of Good Hope. Specimens forwarded by Lieut. L. H. A. Shadwell, R.N.V.R., Officer in charge of works, H.M. Dockyard. From creosoted Danzig timber, No. 3 slip. Many specimens.

Remarks.—This species has been recorded by Chilton (*l. c.*) as destructive in Auckland Harbour, but specimens forwarded from Auckland as *Chelura* proved to be *Corophium contractum* G. M. Thomson, a species, no doubt harmless, also recorded by Chilton.

I learn from Mr. Hamer, however, that this is merely due to a transposition of labels, the *Chelura*, whose identity with the European species is vouched for by Prof. Chilton, being abundant and well known at Auckland.

It appears doubtful whether there is any trustworthy record of *Chelura* occurring apart from *Limnoria*. The gathering from Simon's Town seemed at first sight to consist exclusively of *Chelura*, but on closer examination 13 specimens of *Limnoria* were discovered among more than 300 of the other genus. If these numbers are at all representative of the proportion in which the two species were living in the wood, the great preponderance of *Chelura* is very remarkable. The only previous record of *Chelura* from South Africa appears to be that of Hammersley-Heenan, who found it at Port Elizabeth in 1893 (Trans. S. African Phil. Soc. v. p. 316), and it is noteworthy that no mention is made of its being accompanied there by *Limnoria*.



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