SHIPWORMS OF INDIA. II

Seven more Shipworms from South India

By N. Balakrishnan Nair, *Zoology Research Laboratory, Madras*

Introduction

In a previous paper[1] the author had described ten shipworms from Madras, five belonging to the genus *Bankia* Gray, and five to the genus *Teredo* Linnaeus. Of these, seven were new to science. But the examination of more material collected from both the east and west coasts of South India has yielded seven more forms, one assignable to genus *Bankia* and the rest to the genus *Teredo*. Four of these, *Bankia* (*Nausitora*) *gabrieli*, *Teredo* (*Teredo*) *indica*, *Teredo* (*Teredora*) *minoris* and *Teredo* (*Teredothyra*) *linearis*, are new to science. *Teredo* (*Teredo*) *parksi* and *Teredo* (*Teredo*) *furcillatus* described in this paper were first recorded from the Pearl Harbour and Samoa by Bartsch (1921) and Miller (1924) respectively, and subsequently from other areas in the Pacific (Sivickis 1928, Edmondson 1942) and Indian oceans (Moll 1936). This clearly shows the extensive range of distribution not only of these forms, but of other forms as well. Although the occurrence of *Teredo* (*Teredo*) *navalis* in the European waters has been reported by several authors and also in Cochin (Erlanson, 1936) and Vizag (Ganapati and Nagabushanam, 1954) the Indian form does not appear to have been properly studied. As will be obvious from the description given in this account it differs from the European form in several minor details which are probably of ecotypal nature.

Since very little is known about the Teredine fauna of the Indian coast, an attempt has been made here to give detailed descriptions of the forms occurring in the area. It is hoped that a thorough search of the underwater wooden structures, the native wooden crafts plying in the brackish waters and the lush vegetation fringing the coastal regions which are subjected to submergence under sea water during spring tides, would not only yield more material but also indicate the extent to which the forms described are distributed.

The material for the present study has been recovered from the drift logs or planks washed ashore in large numbers on Madras beach especially during the north-east monsoon times, from temporary marine structures made of timber, from hulls of boats and with the help of wooden test blocks fixed in the sea.

Systematic Account

Genus *Bankia* Gray

Subgenus *Nausitora* Wright

Bankia (*Nausitora*) *gabrieli*, sp. nov.

[1] *Rec. Indian Mus.* LII, pp. 387-414 (1956).

Genus *Teredo* Linnaeus
Teredo (*Teredo*) *parksi* Bartsch var. *madrasensis*, nov.
Teredo (*Teredo*) *furcillatus* Miller
Teredo (*Teredo*) *indica*, sp. nov.
Teredo (*Teredo*) *navalis* Linnaeus
Subgenus *Teredothyra* Bartsch
Teredo (*Teredothyra*) *linearis*, sp. nov.
Subgenus *Teredora* Bartsch
Teredo (*Teredora*) *minoris*, sp. nov.

Genus **Bankia** Gray, 1840

1840. *Bankia*, Gray, *Gen. Synops. Brit. Mus.* 42nd ed., p. 150, *nomen nudum*.
1842. *Bankia*, Gray, *Gen. Synops. Brit. Mus.* 44th ed., p. 76 (diagnosed but no species named).
1847. *Bankia*, Gray, *Proc. zool. Soc. Lond.* p. 188. (as synonym of *Xylotrya* Leach, 1817).

Subgenus **Nausitora** Wright, 1865

Type: *Bankia* (*Nausitora*) *dunlopei* Wright
1865. *Nausitora*, Wright, *Trans. Linn. Soc.* XXIV, p. 51, pl. 46.
1922. *Nausitora*, Wright, *Bull. U. S. nat. Mus.* CXXII, p. 12.

Bankia (Nausitora) gabrieli, sp. nov.

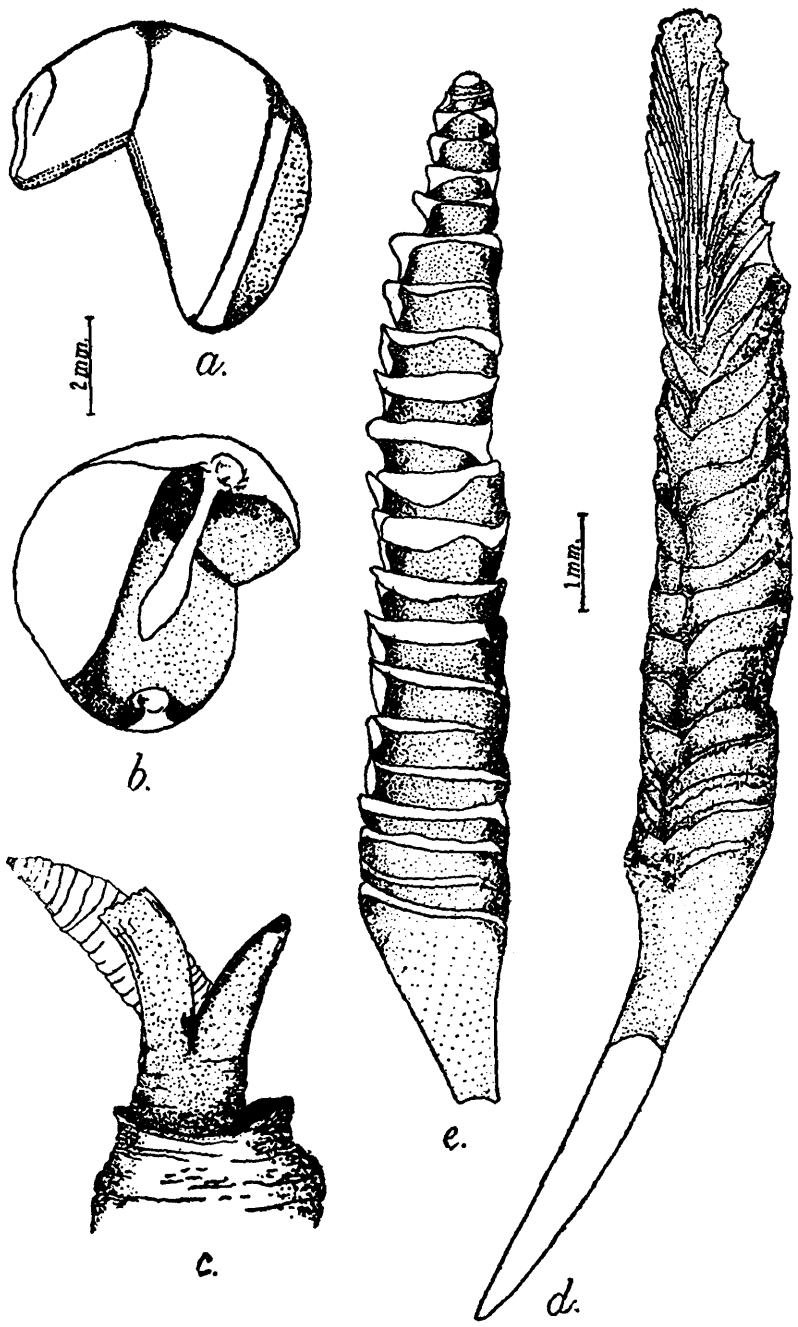
Locality.—Seven shipworms were collected by Rev. Fr. Gabriel from the hull of a discarded country canoe made of teak-wood at Ernakulam, West coast.

Measurements.—The largest specimen measured 15 cms. long (alcohol preserved). But the author has seen one specimen of the same species in the collection of Rev. Fr. Gabriel measuring more than 12″ One specimen 13·5 cms. long has been selected as the type of the species.

Shell length—5·7 mm. Shell height—5·9 mm. Pallet length—13·7 mms., Pallet stalk—3·4 mms.

Characters.—The shell is sub-globular and its height is more than the length. The ventral half of the anterior lobe and anterior part of the median lobe are slate coloured. The anterior lobe is large and is almost as wide as the anterior part of the median lobe. The umbonal side of this lobe has undergone considerable erosion and the dental ridges borne by it have been worn away leaving an almost smooth area. However, towards the ventral side about 35 dental ridges could be counted. They slightly bend downwards after their origin from the moderately deep sinus and then extend backwards across the lobe to meet the anterior end of the dental ridges of the anterior median portion, almost at a right angle. These dental ridges are of regular width and their edges are finely serrated. These ridges are separated by spaces as wide as themselves. The denticles on the median part are tubercular and stronger than those of the anterior lobe. The median lobe of the shell is large and its anterior part bearing the dental ridges is the broadest part of the shell formin nearly 44 per cent of entire length and 76 per cent of the median par The umbonal side of this region also has undergone extensive erosion and the dental ridges are clearly visible only on its anterior 2/3, there being only 30 denticulated ridges. The middle portion of the

median part forms a depressed groove which is crossed by rough wrinkles, and the non-denticulated curved extensions of the dental ridges of the anterior area. There is a ridge running parallel to its length along the middle of this groove from the umbonal region to the extreme ventral tip where the knob is placed. The posterior median is narrow, convex and comparatively smooth. The shell of this species appears quite



TEXT-FIG. I.—*Bankia* (*Nausitora*) *gabrieli*, sp. nov.

a.-b. Outer and inner views of the shell ; *c.* Posterior extremity of the animal showing the collar, siphods, and pallet (one side only) ; *d.* Outer view of the entire pallet *e.* Inner view of the blade of the pallet.

remarkable, as the article is so greatly reduced by erosion that very little of it could be seen. The posterior margin of the median lobe is also eroded and its outline is irregular.

Viewed from within, the hinge area shows an eroded condition. The umbone bears a strong knob from which a blade extends for a little more than half the distance into the cavity of the shell, the distal end of

which is slightly flattened leaving the proximal part to appear like a cylindrical stalk for it. A shelf is indicated beneath the posterior median area.

Pallets : Feather-shaped, with a cylindrical stalk which is much shorter than the blade. The blade is inequilateral and composed of compactly packed cones. Towards the basal part of the blade the cones are more compact and almost fused. The outer surface of the blade is decidedly convex, whereas the inner surface is flat. The blade is covered by a periostracum of a brownish hue. On the inner portion of the blade is a series of cross ridges marking the condensed cone-in-cone elements and periostracum.

Siphons : In the preserved specimens the siphons are short and conjoint until near the extremities. The inhalant is slightly thicker than the exhalant and is trumpet-shaped, fringed at the margin.

Collar : Well developed, but not rolled out as in the other Madras form, *Bankia (Nausitora) madrasensis* Nair.

Labial palps : Very small, being greatly reduced, seen as slight ridges.

Burrow : The calcareous tubing is very thick and non-adherent to the wall of the burrow.

Remarks.—In the possession of a pallet consisting of a series of cone-in-cone elements which are not entirely free at their distal ends but fused in the exterior surface, this Madras species is assignable to the subgenus *Nausitora* Wright. In the marked absence of an auricle it resembles *Bankia triangularis* Sivickis, *Nausitora messeli* Iredale, *et al*, but differs from the former in having very few denticulated ridges on the anterior and anterior median lobes when compared with that form in which it is reported as having about 300 ridges sculpturing that area. The anterior median area of the new species appears much more broader forming 44 per cent of the entire shell length and 76 per cent of the length of the median lobe, whereas in *triangularis*, it is described as about 1·5 times the rest of the median area and auricle combined. Further, *Bankia triangularis* is described as having a pallet of " medium size " with very closely packed cones, the composite nature of which is best seen from the outer surface. In the specimens before me the cone-in-cone elements forming the blade are clearly distinguishable both from the inner and outer surfaces. They resemble *Nausitora messeli* with respect to the shell characters, but differ markedly in the comparative structure of their pallets. In *Nausitora messeli* the specimen with a shell 15 mm. long and 15 mm. high possesses a pallet 21 mm. long, of which only 1·6 mm. belong to its stalk (blade width 1·2 mm.). In the present form when the shell is 5·7 mm. long and 5·9 mm. high the pallet is 13·7 mm. and its stalk measures 3·4 mm. *Bankia (Nausitora) braziliensis* Bartsch agrees with the new form in having partially eroded umbones and also in having a rather broad anterior median portion and a narrow auricle, but differs in the possession of a posterior median portion which is as wide as the anterior and middle portion of the median part. Besides these, the pallet of that species has a comparatively longer stalk and the distal half of the blade is covered with a thick calcareous deposit. Further, the relative proportions of the shell and pallets are also different.

Bankia quadrangularis Sivickis, *Bankia globosa* Sivickis, *Bankia* (*Nausitora madrasensis* Nair, also approach the new shipworm in the possession of a shell having a narrow auricle, while *Bankia quadrangularis* differs markedly from that in having 90 ridges for the anterior part and in having an anterior median portion which is almost equal to the middle median and posterior median put together and also in the possession of stout pallets with U-shaped cones and peg-like peduncle appearing as long as the blade. *Bankia globosa* differs in having a broad posterior median portion which equals in breadth to the anterior median unlike the form in question. In *Bankia* (*Nausitora*) *madrasensis* the pallet structure appears so different that the similarity observed in its shell structure has had to be considered quite insufficient as to suggest a resemblance.

After carefully comparing the important features of the specimens in question with those of other existing species it is found that they certainly come under the subgenus *Nausitora* and represent a peculiar form hitherto unknown to science which I venture to designate as *Bankia* (*Nausitora*) *gabrieli* after Rev. Fr. Gabriel of Sacred Heart College, Thevara. The description of this new species is given as follows :—

Shell height slightly more than shell length, with a very wide anterior median area forming 76 per cent of the length of the median lobe and wider than the anterior lobe and about 3 times the width of the rest of the median lobe, with an auricle which is very greatly reduced or completely absent and with a pallet which has a blade greatly longer than the stalk, the former composed of closely packed cone-in-cone elements covered over by a brownish periostracum.

Genus **Teredo** Linnaeus, 1758

Subgenus **Teredo** Linnæus

1758. *Teredo*, Linnaeus. *Syst. Nat.* 10th ed., p. 651.
1922. *Teredo*, Bartsch, *Bull. U. S. Nat. Mus.* No. CXXII, p. 17.

Teredo (Teredo) parksi Bartsch var. **madrasensis**, nov.

1921. *Teredo* (*Teredo*) *parksi*, Bartsch, *Proc. Biol. Soc. Wash.* XXXIV, pp. 28-29.
1942. *Teredo* (*Teredo*) *parksi*, Edmondson, *Occ. Pap. Bishop Mus.* XVII (10), p. 106.

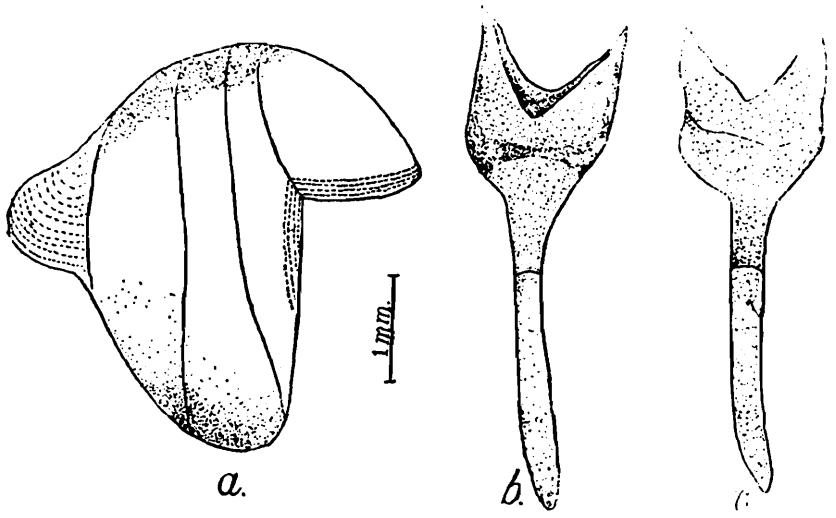
Locality.—Two specimens were collected from a test plank of *Myristica* sp. fixed in the boat basin of the Madras harbour which was in water from August 7th to November 15th, 1954. The test plank was also bored by *Martesia* and fouled thickly by barnacles, lamellibranchs, hydroids, and polyzoans. *Sphæroma* were also present in the empty tunnels of the borers. Besides the two entire specimens, shells and pallets were also obtained from empty burrows from the same plank.

Measurements.—Length of the specimen (burrow) 6·3 cms. Shell length—3·7 mm. Pallet—3·7 mm. Shell height—3·6 mm. Pallet stalk—2·1 mm. Breadth of the blade—1·3 mm.

Characters.—Shell white, globular, longer than high with sinus and callus and its anterior lobe bearing not less than 45 dental ridges which meet those of the anterior median almost at right angles. The anterior

median is moderately broad and marked by closely packed dental ridges bearing stronger denticles than those on the anterior lobe. The junction between the ventral border of the anterior lobe and anterior median portion forms a right angle. The middle median is a fairly broad and depressed area crossed by strong incremental lines. The posterior median is convex and thick and is also crossed by similar incremental lines of growth. The auricle is small, wider than high and marked by concentric lines. Internally the shell is smooth with strong dorsal and ventral knobs. From the inner underside of the dorsal knob a flat blade is pendent which hangs into the cavity of the shell for about half its length.

Pallet.—Paddle-shaped, with a long slender stalk which is slightly curved and about twice the length of the expanded part of the blade. Blade is excavated at the distal end more deeply on the convex outer face than on the flattened inner face.



Text-fig. 2.—*Teredo* (*Teredo*) *parksi madrasensis*, var. nov.
a. Outer view of the shell; *b*.-*c*. Outer and inner views of the Pallet.

Collar.—Slightly developed.

Siphons.—Inhalant wider and longer.

Burrow.—With thin lining.

Remarks.—This species was described by Bartsch (1921) from piling in Pearl Harbour. It has subsequently been reported by Miller (1924) as occurring in the test blocks in Samoa, and Sivickis (1928), declared it to be common in the Philippine islands. Edmondson (1942) recovered it from several stations about Hawaii and Moll (1936) listed it from Penang island. A distinctive feature noticeable in the present form is the absence of a black or brown colour for the periostracum which results in giving the blade a white appearance. In this feature the pallets are contrasted with those of *Teredo parksi* reported by Bartsch from Pearl Harbour and Miller and Edmondson from the Pacific islands. A full description of the Penang form is not available. In view of the differences exhibited by the Madras specimens both in shell and palletal features, I propose for them the new varietal name *madrasensis* and give the description as follows :—

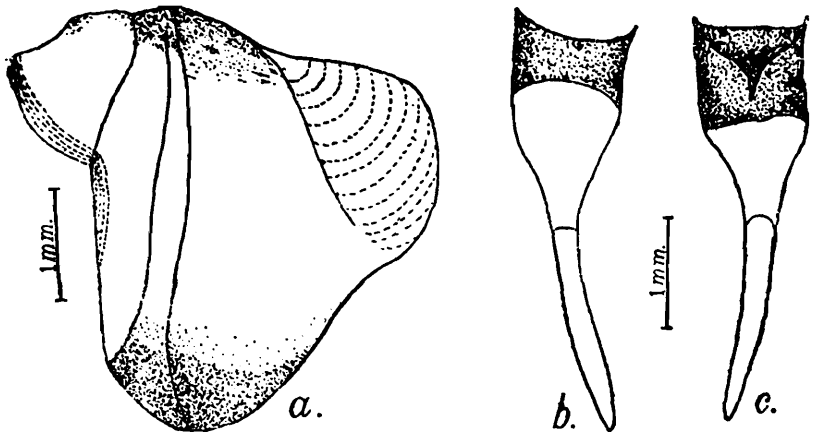
The shell with a broad anterior lobe and a small auricle, pallets with along slightly curved stalk which is about twice the length of the expanded part of the blade, the distal end of the latter excavated more deeply on

The covex outer face than on the flattend inner face. The periostracum covering the distal part of the blade is colourless.

Teredo (Teredo) furcillatus Miller, 1924

1924. *Teredo furcillatus*, Miller, *Univ .Calif. Publ. Zool.* XXVI, p. 149, pl. 10, figs. 16-20.

1942. *Teredo (Teredo) furcillatus*, Edmondson, *Occ. Pap, Bishop Mus.* XVII (10), p. 113.



TEXT-FIG. 3.—*Teredo (Teredo) furcillatus.*

a. Outer view of the shell ; *b.*-*c.* Inner and outer faces of the pallet.

Locality.—Three specimens were collected from a plank of *Mangifera* sp. used in a jetty construction in the Kayankulam backwaters on the west coast during the month of October, 1953. On close examination these were found to be *Teredo (Teredo) furcillatus* described by Miller (1924) from Tutuila and Honolulu harbour. Certain differences as observed in the Indian and Honolulu forms are pointed out below.

Measurements.—Shell height—3·8 mm. Shell length—4 mm. Pallet length—3·7 mm. Pallet stalk—1·9 mm. Breadth of blade—1 mm.

Characters.—Shell subglobular with its length more than the height The anterior lobe with sinus and reflected callus is crossed by about 20 denticulated ridges which are separated by spaces twice as wide as themselves. These dental ridges meet those of the anterior median part in slightly more than a right angle. The anterior median part is moderately broad and is crossed by about the same number of ridges as on the anterior lobe with the denticles stronger and more compactly placed being separated only by mere lines. The middle median area is a depressed groove crossed by the non-denticulated extensions of the dental ridges of the anterior lobe. The posterior median part is convex and is the widest part forming about 68 per cent of the length of the median area and is crossed by the further extensions of the dental ridges. The posterior part forms a very prominent auricle slightly broader than even the anterior lobe and its surface is marked by strong lines of growth.

Pallets.—Paddle-shaped with the stalk longer than the blade. The distal tip of the latter is deeply excavated on the outer margin, while the inner margin is only slighly cupped. The distal half of the blade is covered by an yellowish brown periostracum.

Siphons.—In alcohol preserved specimens the inhalant and exhalant siphons are of equal length. The inhalant is coloured brown.

Collar.—Moderately developed.

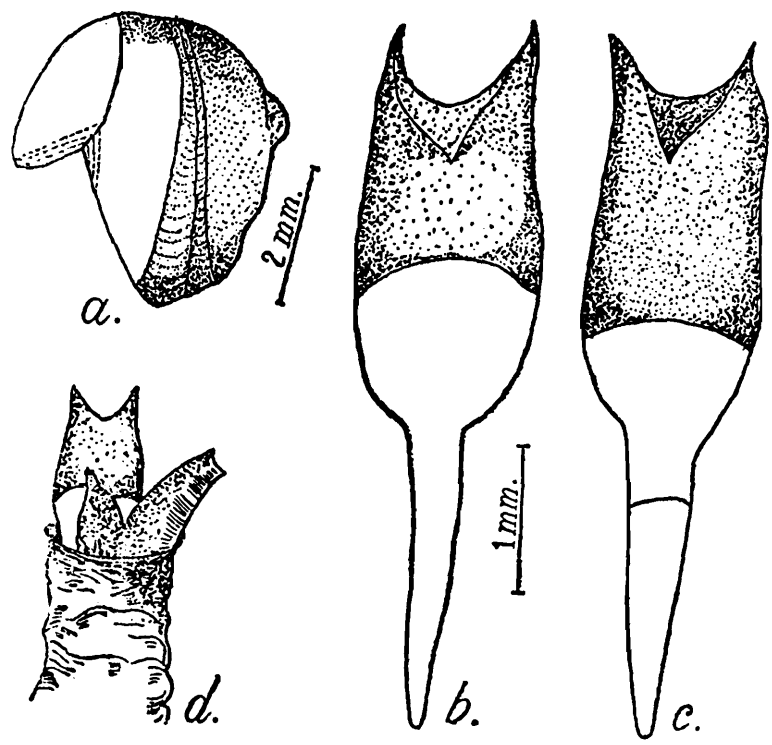
Burrow.—Information not available.

It has been reported as occurring in the Cochin harbour by Erlanson (1936).

Remarks.—For a new shipworm collected from Tutuila, Samoa, Miller (1924) used the specific name *furcillatus*. His description ' shell with the anterior lobe shorter and narrower than *Teredo parksi* and the auricle decidedly longer and broader ' holds good for the Madras forms as well.

Teredo (Teredo) indica, sp. nov.

Locality.—Three live specimens were recovered from a test plank of *Myristica* sp. fixed in the boat basin of the Madras harbour which was in water from April 10th to July 19th, 1954. The wood was riddled by *Martesia*. The empty tunnels of this species with shells and pallets were also found besides the three live ones.



Text-fig. 4.—*Teredo* (*Teredo*) *indica*, sp. nov.

a. Outer view of the shell; *b.-c.* Inner and outer views of the pallet; *d.* Posterior extremity of the animal showing collar, siphons and pallet (one side only).

Colour.—The caecum of this new shipworm was very conspicuously coloured pink which was clearly visible through the translucent mantle in the fresh specimens. This colouration is rather remarkable in view of the fact that the wood into which the animal was boring and with which the caecum was filled up was colourless. The siphons had a brownish hue.

Measurements.—The animal is slender and the burrow of the largest of the three measures 5 cms. It is selected as the type.

Shell length—4 mm., Shell height—4·1 mm., Pallet length—4·3 mm., Palllet stalk—1·6 mm., Breadth of the blade—1·2 mm.

Characters.—Shell globular, thin and white. The anterior part has a moderately deep sinus, the extreme anterior margin of which is covered with a fairly thick callus reflected over the exterior. The rest of the anterior lobe is sculptured by slender rib-like denticulated ridges. They are more closely approximated at the anterior callus than at their junction with the median part where the spaces that separate them are about as wide as the ridges. Not less than 53 of these ridges are present in the type, some of the early ones, however, are worn out at the umbone. In cross section the dental ridges are roughly triangular and bear numerous minute closely spaced denticles on their outer dorsal margin. The anterior median part joins the anterior part at its ventral margin in almost a right angle. The junction of the anterior lobe with the median part appears as a slightly impressed line extending from the umbones to the ventral margin. The anterior median part is broad forming about 31 per cent of the total length of the shell and about 47 per cent of the median part and is marked by closely packed dental ridges bearing denticles which are stronger and stouter than those of the anterior lobe and whose long axis is transverse to that of the ridges. The ridges are separated by deeply impressed lines only. They meet those of the anterior area almost at right angles. The middle median portion is a light yellowish, depressed groove crossed by the enfeebled non-denticulated extensions of the dental ridges of the anterior area. The posterior median is convex and its surface is marked by rather irregular incremental lines. This part forms a small auricle marked by weak lines of growth.

Interior white. The umbones form a small dorsal knob from the inner underside of which is pendant the apophysis which is thin and broad extending for more than half the distance of the inside of the shell towards the ventral knob. The junction of the anterior and median part forms a thread-like ridge. The posterior portion extends over the median as a prominent shelf.

Pallets.—Paddle-shaped, with stout cylindrical stalk tapering to a point. The distal $\frac{2}{3}$ of the blade is covered by a dark brown periostracum and the extreme distal portion of this region is hollowed out and the lateral tips are drawn out as two horns, the left one of which is slightly longer.

Siphons.—The inhalant is wider and twice as long as the exhalant and with the rim fringed.

Collar.—Slightly developed.

Burrow.—Lined by thick calcareous material which is not firmly adherent to the walls of the burrow.

This is an incubatory species. The specimens on removal from the wood when placed in a bowl of fresh sea water extruded a stream of larval veligers. These were cultured in the laboratory successfully and the details of development are reserved for a separate paper. The veligers had translucent shells and showed great activity. Immediately after their release from the mantle cavity of the mother they descende rapidly to the bottom of the bowl. Within one or two minutes they

protruded their velum and began creeping about the bottom first in a straight line for a short distance after which they began moving in circles and swam up towards the surface.

Remarks.—In the possession of a shell whose height is slightly more than its length, with anterior lobe bearing not less than 53 denticulated ridges, a broad anterior median area which forms about 47 per cent of the median part and bearing an equal number of denticulated ridges as the anterior lobe, having an auricle, which is very small and narrow, an apophysis which is broad and thin, and in the possession of a paddle-shaped pallet having a small straight cylindrical stalk which tapers to a point, with a blade whose breadth is less than the length of the stalk, the distal $\frac{2}{3}$ of which is covered by a dark brown periostracum and the extreme distal portion hollowed out and the lateral tips drawn out, the present form is clearly distinguishable from all the other 31 forms whose descriptions or figures are avilable for purposes of comparative study and hence treated as a new species *Teredo* (*Teredo*) *indica* which is described as follows :

Shell height more than shell length with anterior lobe having 53 dental ridges and an equal number of dental ridges for the anterior median lobe when the shell is 4 mm. long and 4·1 mm. high. The anterior median lobe forms about 47 per cent of the median part, while the posterior region of the latter forms a very narrow and small auricle. Pallets with short cylindrical stalks measure 1·6 mm., when its overall length is 4·3 mm., with a blade the broadest part of which measures 1·2 mm. and the distal $\frac{2}{3}$ of which is covered by a dark brown periostracum.

Teredo (Teredo) navalis Linnaeus

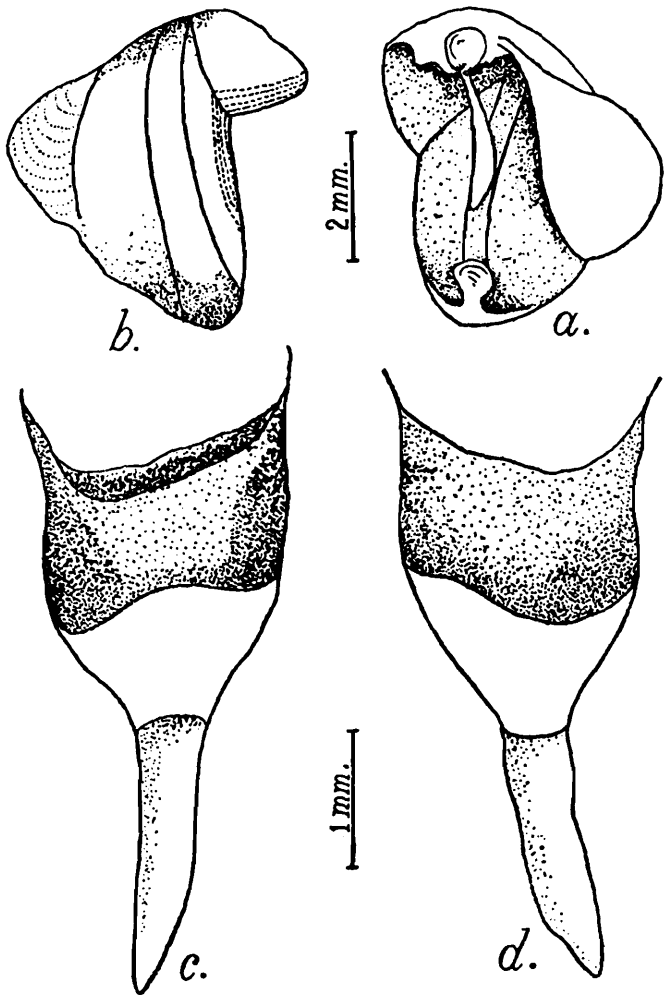
1758. *Teredo navalis*, Linnaeus, *Syst. Nat.* 10th ed., p. 651.

Locality.—Four specimens were collected from a test plank submerged for sixty-six days, 2 miles from the Madras beach beyond San Thome. 3 more were collected from Alleppey on the West coast by Sreemati Gomati Balakrishnan during June, 1954, from a discarded canoe. Of the specimens collected from the test plank, the largest had a burrow measuring 9·5 cms. in length. It is presumed that this form is about 66 days old.

Measurements.—Shell height—4·8 mm., Shell length—4·7 mm., Pallet length—4 mm., Pallet stalk—2 mm., breadth of blade 1·6 mm.

Characters.—Shell sub-globular, slate coloured except the dorsal side of the posterior median and auricle. The anterior margin of the anterior lobe with a moderately deep sinus is covered with a smooth translucent callus which is reflected over the exterior portion where the dental ridges are covered by it. The dental ridges radiate from this anterior smooth portion fan-shaped backwards over the anterior lobe in an even gentle curve. They are separated at the posterior extremity by spaces about twice as wide as themselves. There are about 30 of these ridges, but a few at the umbone are eroded. They are finely denticulated at their free border. The anterior median part joins the anterior part at its ventral margin in almost a right angle. The junction of the anterior part with the median part appears as a slightly impressed

line extending from the umbone to the ventral margin. The dental ridges of the anterior lobe meet those of the anterior median in almost a right angle. The anterior part of the median area is marked by 18 dental ridges bearing fine denticles. The middle median portion is a shallow concave area crossed by the non-denticulated curved extensions of the dental ridges of the anterior median portion and coarse wrinkles which make the surface of this area quite rough. The posterior median area is convex and its surface is crossed by the further extensions of the non-denticulated dental ridges which end at the junction of the posterior median with the auricle. The auricle which is given off by the posterior



TEXT-FIG. 5.—*Teredo* (*Teredo*) *navalis.*
a.-b. Inner and outer views of the shell ; *c-d.* Outer and inner faces of the pallet.

median is a conspicuous one and its surface is marked by concentric lines of growth paralleling the ventral margin. The interior is white. The anterior part joins the middle part in a raised tumidity. The inner surface is smooth except the auricle which shows concentric lines. The auricle extends over the posterior median as a moderately strong shelf. The umbones are curved inwards and form a prominent knob from the underside of which extends for more than half the distance into the cavity of the shell the apophysis, which is flat and thick and is orientated at right angles to the inner surface of the median part. The extreme ventral tip of the median part bears a strong knob.

Pallets : are spatulate, with a straight cylindrical stalk which is almost of the same length as the blade. The distal part of the blade forms a dark-brown periostracum which is hollowed out at the free margin

and terminates in two lateral horns. The basal calcareous portion of the blade is slightly convex outside and flat in the inner face.

Siphon.—The inhalant siphon is fringed at the tip, but wider and stouter than the exhalant which extends for only half the length of the inhalant siphon.

Burrow.—Lined with thick calcareous material. The opening is a simple slit without any septa or partitions.

Remarks.—In the possession of a shell with a moderate sized auricle, with an anterior lobe possessing 30 denticulated ridges and anterior median with 17 denticulated ridges, it almost agrees with the description of *Teredo navalis* quoted by Bartsch (1922). The pallet of the present form has an overall length of 4 mm. of which 2 mm. belong to its stalk which is straight terminating in a point, whereas in the former the stalk is decidedly shorter, slightly twisted and somewhat dilated at its tip. Further, in the Madras form the blade expands beyond the stalk much more than in the European form forming a concave outline (though not so suddenly as in the American species). Its inhalant siphon is also markedly longer than the exhalant siphon. In the absence of a more detailed information about the type of *Teredo* (*Teredo*) *navalis* the specimens before me are tentatively referred to *navalis*.

Subgenus **Teredothyra** Bartsch

Type : *Teredo* (*Teredothyra*) *dominiecensis* Bartsch

1921. *Teredothyra*, Bartsch, *Proc. biol. Soc. Wash.* XXXIV, p. 26.

1922. *Teredothyra*, Bartsch, *Bull. U. S. nat. Mus.* No. CXXII, p. 22.

1927. *Teredothyra*, Bartsch, *Bull. U. S. nat. Mus.* No. C, p. 540.

In this subgenus the pallets are doubly cupped at the terminal portion.

Teredo (Teredothyra) linearis, sp. nov.

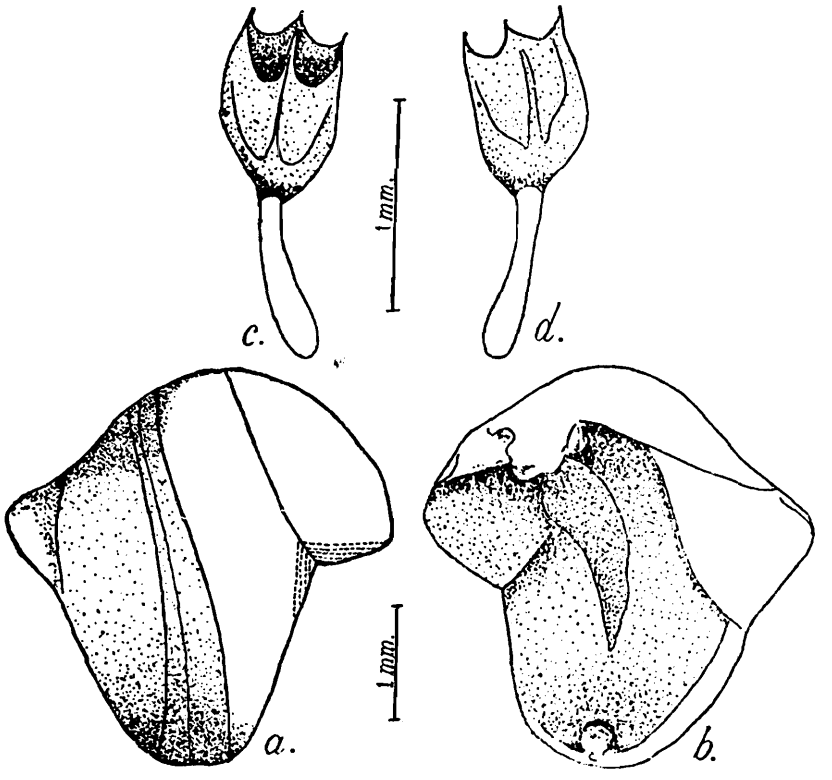
Locality.—Three specimens were collected from a floating piece of Maruthu wood (*Terminalia arjuna*) in the Royapuram shore on the 19th January, 1954. All of them were small, but the burrow of the largest measured only 3·5 cms. long, the shell and the visceral mass were thin and the branchial region very thin and drawn out at the tip of which the small pallets could be seen.

Measurements.—Shell length—3·4 mm., Shell height—3·5 mm. Pallet length—1·7 mm., Pallet stalk—0·8 mm., Breadth of blade—0·5 mm.

Characters.—Shell sub-globular and white. The anterior lobe is provided with deep sinus and reflected callus. This area is crossed by not less than 100 denticulated ridges which are separated by spaces as wide as the ridges at their junction with those of the anterior median. A few dental ridges are eroded at the umbonal region The anterior median area is broad, broader than the posterior median and almost of the same width as the anterior lobe and its surface is crossed by an equal number of denticulated ridges which are closely packed, being separated only by mere impressed lines. They meet those of the anterior lobe at

slightly more than a right angle. The middle median is a shallow depressed area having a central groove running throughout its length from the umbone to the ventral knob and is crossed by non-denticulated ridges which extend into the convex posterior median area, the latter giving off an auricle at its dorso-median aspect. The auricle is narrow, bearing on its surface thin incremental lines.

Interior is white and smooth, the umbonal knob is slightly smaller than the ventral knob from the inner underside of which is pendent a broad blade which extends for slightly more than half the distance into the cavity of the shell. The junction of the anterior lobe with the median is marked by a tumid ridge. The auricle does not strongly project into the cavity of the shell as a conspicuous shelf.



TEXT-FIG. 6.—*Teredo* (*Teredothyra*) *linearis*, sp. nov.
a.-b. Outer and inner views of the shell ; *c.-d.* Outer and inner faces of the pallet.

Pallets : are small with short cylindrical slightly twisted stalk, the latter occupying only 47 per cent of the entire length of the pallet. The expanded blade is hollow throughout its length, the cavity being divided into two chambers by a median septum.

Burrow has a thin calcareous lining which is adherent to the wood.

Remarks.—This form belongs to the subgenus *Teredothyra* Bartsch which is characterised by its pallets being doubly cupped terminally. If the important characters are carefully studied and compared with those of the other nine forms belonging to this subgenus, one would be surely inclined to consider this boring mollusc as quite new to science. But of all these species, its resemblance to *Teredo* (*Teredothyra*) *dominiecnsis* Bartsch appears more close especially in the form of the pallets. It can easily be distinguished from other species of the group by the possession of a shell whose height is always slightly more than its length, an anterior lobe which is higher than broad bearing about 100 denticulated ridges which meet those of the anterior part of the median lobe at slightly

more than a right angle, with a distinct moderately broad convex and smooth posterior median part which is about 38 per cent of the length of the middle lobe of the shell having a narrow auricle at its posterior dorsal part which does not strongly project into the cavity of the shell as a conspicuous shelf and having an apophysis which is broad and long. So, I take the liberty to propose for this the new specific name *linearis* and give the description as follows :—

Animal slender with a thin viscera and enlongated branchial region shell, the height of which is more than its length, with a moderately broad anterior median part and on almost equally broad posterior median part with narrow auricle placed postero-dorsally which does not strongly project into the cavity of the shell to form a shelf and with pallets which are doubly cupped at the terminal portion with overall length of 1·7 mm. (when the shell is 3·4 mm, long and 3·5 mm. high), about 47 per cent of which belongs to its stalk, the blade of which is hollow throughout its length, the cavity being divided into two chambers by a medium septum.

Subgenus **Teredora** Bartsch,1921

Type *Teredo malleolus* Turton

1921, *Teredora*, Bartsch, *Proc. biol. Soc. Wash*, XXXIV, p. 26.

1922, *Teredora*, Bartsch, *Bull. U. S. nat. Mus.* CXXXII, p. 32.

1942, *Teredora*, Edmondson, *Occ. Pap. Bishop Mus.* XVII (10), p. 127.

Teredo (Teredora) minori, sp. nov.

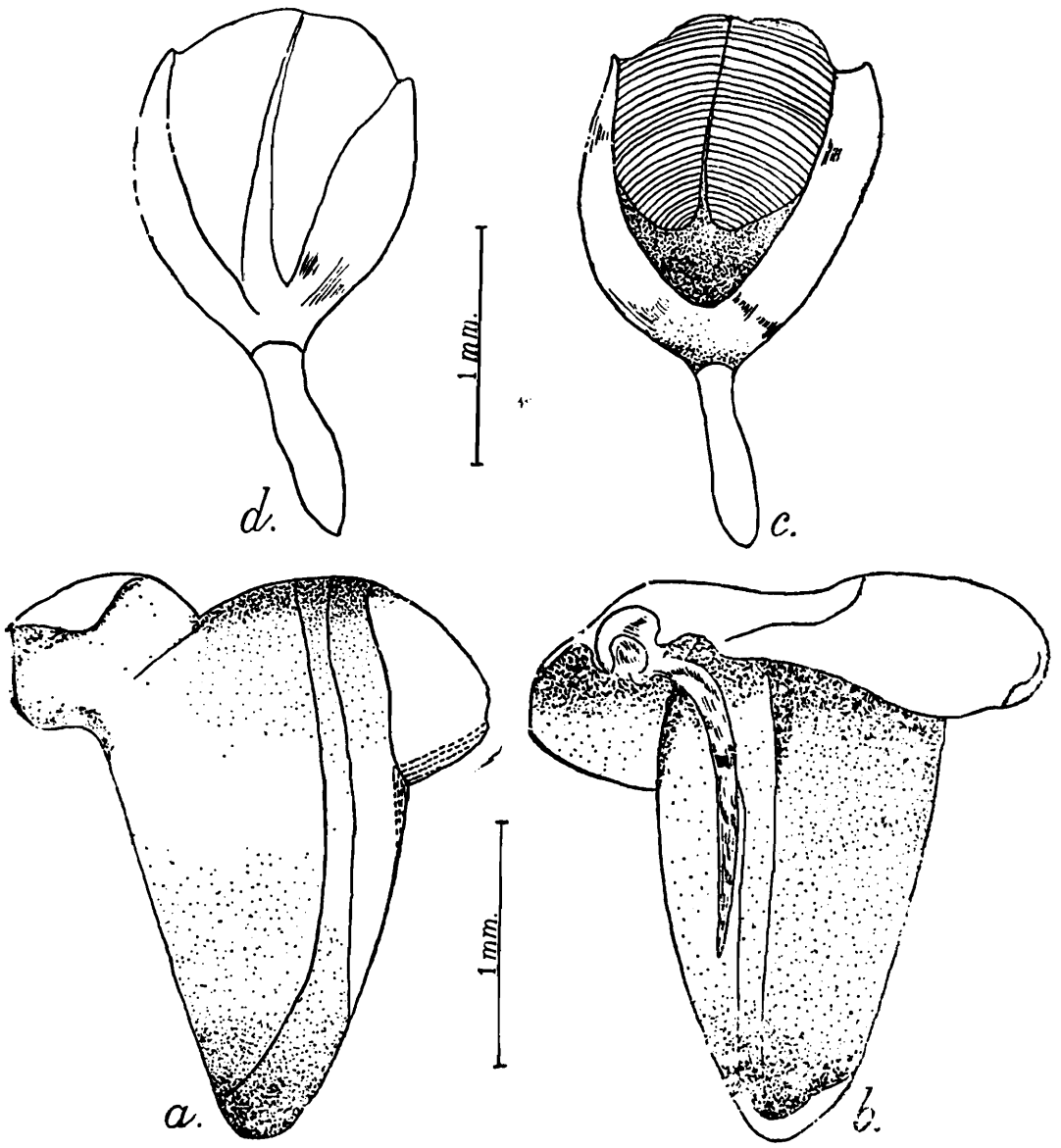
Locality.—Five specimens were recovered from a floating log on 12th January, 1954 from the Madras coast.

Measurements.—The burrow of the largest and sexually mature forms measured 3·2 cms. Shell length—2·0 mm. Shell height—24 mm. Pallet length—2·2 mm. Pallet stalk—0·8 mm. Breadth of blade—1·2 mm.

Characters.—The median part of the shell is considerably elongated and the anterior lobe and the anterior part of the median lobe are coloured light green. The anterior lobe has a shallow sinus and a reflected callus. From the former the dental ridges numbering notless than thirty emerge and pass backwards in an even curve. Some of these ridges are eroded at the umbonal region and separated by spaces about twice as their width. The anterior part of the median lobe is a narrow region and bears on its surface closely crawded dental ridges (of an equal number as on the anterior lobe) bearing stouter denticles at their free margins, the adjoining ridges being separated by mere impressed lines only. The middle-median portion forms a shallow area through the centre of which extends a very rough groove from the umbone to the ventral margin which is crossed by the enfeebled sub-obsolete extensions of the nental ridges. The posterior median portion is very broad, about twice as wide as the anterior and median part taken together. This area is smooth and convex and forms a moderately large exceedingly oblique auricle which is placed on the dorsal margin and is reflected at its distal end. This auricle resembles a pallet attached to the posterior

median part in such a manner that it appears to project as much on inside as on outwards. At the junction of the auricle with the posterior median part there is an inflexion.

The interior of the shell is white. The umbones project into the interior as a strong boss from the ventral side of which is pendant a long cylindrical blade for more than half the distance into the cavity towards the ventral tip. A knob is present at the extreme ventral tip of the median portion. The anterior median portion forms a tumid line at its junction with the anterior lobe. The inner surface of the auricle bears lines of growth.



TEXT-FIG. 7.—*Teredo*'(*Teredora*) *minoris*, sp. nov.

a.-b. Outer and inner views of the shell ; *c.-d.* Outer and inner faces of the pallet.

Pallet.—Small, paddle-shaped with a cylindrical stalk. To the latter is attached a solid blade the median portion of which is depressed and nail like. The nail portion is marked by feeble concentric lines with a tumid ridge starting from its base and running through its centre and tapering to a point at the distal tip of the blade. The inside of the blade is smooth and shows a prominent ridge running through its centre, to the distal tip of the blade.

Burrow.—with a thick calcareous tubing which is adherent to the wood.

Collar.—Slightly developed.

Remarks.—This shipworm may rightly claim its position into the subgenus *Teredora* Bartsch in the possession of a spoon-shaped pallet not cupped at the terminal border and without periostracum and the blade having a nail-like depression marked by concentric lines of growth, a shell with auricle placed upon the posterior median portion in such a way that half of it projects as a shelf inwardly. It resembles *Teredo (Teredora) thomsoni* Tryon in having an obsoletely ribbed pallet blade and a shell with an auricle which is obliquely placed, but differs from it in the possession of a green coloured shell whose height is proportionately much more than its length, whose auricle is of moderate size, the distal tip of which is reflected outwards and whose apophysis is not broad and expanded basally, but cylindrical and tapering to a point. Other differences are shown by the pallet, such as, the absence of the ' pocket ' which is present at the basal margin on the outer side of the Thompson shipworm, and the presence of a tumid ridge running through the centre of the nail-like portion from the base to the tip of the outer face of the pallet. Further the relative proportions of the shell and pallet are also different. Hence the author intends to describe it as a new species based on the important characters mentioned.

Acknowledgments

The author takes this opportunity to express his grateful thanks to Dr. C. P. Gnanamuthu, Director, University Zoology Laboratory, for his help and guidance in the preparation of this paper and to Dr. G. Krishnan, Reader, University Zoology Laboratory, for encouragement. The author is also thankful to Dr. Harald A. Rehder, Curator, Division of Molluscs, United States National Museum, Washington, for sending copies of all the papers published by the United States National Museum on marine boring molluscs.

References

Atwood, W G., and Johnson, 1924.—Marine structures, their deterioration and preservation. Rep. Comm. on Marine Piling Investigations. *Nat. Res. Council, Washington, D.C.* pp.1-534.

Barrows, A. L., 1917.—An unusual extension of the distribution of the shipworm in San Francisco Bay, California. *Univ. Calif. Pub. Zool.* XVIII, pp. 27-43.

Bartsch, P. 1916.—A new *Teredo* from the west coast of America. *Nautilus,* XXX (4), pp. 47-48.

——, 1921.—A new classification of shipworms and descriptions of some new wood boring mollusks. *Proc. biol. Soc. Wash.* XXXIV, pp. 25-32.

——, 1922.—A monograph of the American shipworms. *Bull. U. S. nat. Mus.* CXXII, pp. 1-15, Pls. I—XXXVII.

——, 1923.—Additions to our knowledge of shipworms. *Proc. biol. Soc. Wash.* XXXVI, pp. 95-102.

BARTSCH, P., 1923.—Stenomorph, a new term in taxonomy. *Science, n.s.* LVII, p. 330.

——, 1927.—The shipworms of the Philippine Islands. *Bull. U. S. nat. Mus.* C (2), pp. 533-554.

BLUM, H. F., 1922.—On the effect of low salinity on *Teredo navalis*. *Univ. Calif. Pub. Zool.* XXII, pp. 349-368.

CLAPP, W. F., 1923.—A new species of *Teredo* from Florida (*Teredo bartschi*). *Proc. Bost. Soc. nat. Hist.* XXXVII (2), pp. 31-38, pls. iii-iv.

——, 1924.—Three new species of *Teredo*. *Trans. Acad. Sci. St. Louis*, XXV (1), pp. 1-16, pls. i-iii.

——, 1925.—Notes on the stenomorphic form of the shipworm. *Trans. Acad. Sci. St. Louis*, XXV (5), pp. 81-89, pl. iv.

DALL, W H., BARTSCH, BARTSCH, P. and REHDER, H. F., 1938.—A manual of the recent and fossil pelecypod mollusks of the Hawaiian Islands. *Bull. Bishop. Mus.* CLIII, pp. 1-233, pls. i-lviii.

DESHAYES, G.P., 1863.—Catalogue des Mollusques de l'ile de la Renuion Annexe E, de l'ouvrage intitule, pp. 1-144, pls. i-xiv.

DURAND, W. F., 1887.—Internal parasites of *Teredo navalis*. *J. Am. Mic.* VIII, pp. 224-226.

EDMONDSON, C. H., 1941.—A recent shipworm survey in Hawaii. *Proc. Sixth Pacific Science Congress*, III, pp. 245-250.

——, 1942.—Teredinidae of Hawaii. *Occ. Pap. Bishop. Mus.* XVII (10), pp. 97-150.

——, 1946.—Dispersal of shipworms among central Pacific Islands, with description of new species. *Occ. Pap. Bishop. Mus.* XVIII (15), pp. 211-224.

EDMONDSON, C. H., and INGRAM, W M., 1939.—Fouling organisms in Hawaii. *Occ. Pap. Bishop. Mus.* XIV (14), pp. 251-300 pls. i-ix.

ERLANSON, E. W., 1936.—A preliminary survey of Marine boring organisms in Cochin Harbour. *Current Science*, IV (7), pp. 726-732.

GRAVE, B. H., 1928.—Natural History of the shipworm, *Teredo navalis*, at Woods Hole, Massachusetts. *Biol. Bull.* LV, pp. 260-282.

GANAPATI, P. N., and NAGABHUSHANAM, R., 1954.—Sex reversal in *Teredo*. *Current Science*, XXIII.

HEDLEY, CHARLES, 1900.—The marine wood-borers of Australia and their work. *Austr. Assoc. Advi. Sci. Rept. 8th meeting, Melbourne*, pp. 237-255.

HILL, C. L., and KOFOLD, C. A., 1927.—Marine borers and their relation to marine construction on the Pacific coast. *Final Rept. San Francisco Bay Marine Piling Comm.*

JOHNSON, R. A., MCNEILL, F. A., and IREDALE, TOM., 1936.—Destruction of Timber by marine organisms in the port of Sydney. *Suppl. Rept. No.* 1, *Maritime Services Board of New South Wales*, pp. 1-99, October.

Miller, R. C., 1922.—Variations in *Teredo navalis* in San Francisco Bay *Univ. Calif. Pub. Zool.* XXII (2), pp. 293-328, pls. xiii-xvii.

——, 1924.—Wood-boring mollusks from the Hawaiian, Samoan and Philippine Islands. *Univ. Calif. Pub. Zool.* XXVI, pp. 145-151, pls. 8-11.

Moll, F., 1936.—Les animeux rougeurs de bois sur les cotes de l'Indochine. *Jour. Conchyliol.* LXXX, pp. 296-301.

Moll, F., and Roch, F., 1931.—The Teredinidae of the British Museum, the Natural History Museums of Glasgow and Manchester and the Jeffreys collection. *Proc. Malac. Soc. London.* XIX (4), pp. 201-218, figs. 1-48, pls. xxii-xxv.

——, 1937.—Die geographische Verbreitung der Terediniden Afrikas. *Mitt. Zool. Mus. Berlin.* XXII, pp. 161-189.

Nair, N. Balakrishnan, 1956.—Shipworms of India. I. *Rec. Indian Mus.* LII, pp. 387-414.

Roch. F., 1934.—The Teredinae of the Soviet Union. *Zool. J. Moscow.* XIII, pp. 437-452.

Sigerfoos, Charles., 1908.—Natural history, organisation, and late development of the Teredinidae or shipworms. *Bull. U. S. Bureau of Fisheries.* XXVII, pp. 191-231, pls. vii-xxi.

Sivickis, P. B., 1928.—New Philippine shipworms. *Philip. J. Sci.* XXXVII, pp. 285-298, pls. i-iii.

Watson, C. J. J., McNeill, F. A., Johnson, R. A. and Iredale, Tom., 1936.—Destruction of timber by marine organisms in the part of Brisbane. *Sub. Dept. Forestry, Dept. Public Lands, Bull.* XII, pp. 1-107.

Wilson, Charles Branch, 1942.—Description of a new genus and species of copepod parasitic in shipworm. *J. Wash. Acad. Sci.* XXXII (2), pp. 60-62, fig. 1.