

## SHIPWORMS FROM INDIA.

### 1. REPORT ON TEN SPECIES OF SHIPWORMS FROM THE MADRAS COAST.

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#### INTRODUCTION.

More than two hundred papers have been published by different authors on the Teredines of Britain, Europe, Australia, the Pacific islands and the New World. Of these, the papers of Atwood and Johnson (1924), Bartsch (1922), Edmondson (1941), Hill and Kofoid (1927), Iredale *et al* (1932), Jeffreys (1860-61), Lamy (1926), Miller (1924), Moll (1936), Moll and Roch (1937), Sivickis (1928), and Wright (1866) are purely taxonomic, Bartsch (1922) giving the most acceptable scheme of classification which has since been adopted by many workers in the field. Though Teredines have been extensively studied in the various countries, our knowledge of the tropical forms is very meagre. Except for a short account by Erlanson (1936) of the forms she found at Cochin Harbour, no paper has been published so far about the shipworms of India. The present study was undertaken as a preliminary to the investigations of the anatomy, life history, and physiology of these tropical forms which cause serious damage to timber structures along the sea front.

The present account deals with ten species, of which seven, on consultation with Dr. Edmondson, are found to be new to science. The remaining three which have already been recorded, *Bankia* (*Bankia*) *bipalmulata* Lamarck, *Teredo* (*Teredora*) *clava* Gmelin, *Teredo* (*Teredora*) *gregoryi* Dall *et al* are also described fully since the available descriptions are incomplete and since these tropical forms show slight differences from their type specimens. In the treatment of the species the classification given by Bartsch (1922) has been followed and an attempt has been made to consider both hard and soft parts for the exact determination of relationships of species.

Nearly eight hundred entire specimens of shipworms of different sizes, collected from country log-rafts, dragged ashore as not seaworthy; from timber floats used in fishing, and driftwood which were washed ashore, formed the material for the present study. About hundred forms were obtained with the help of test-planks. It may be inferred therefore, that many more species may yet be found if the wooden crafts and timber structures all over the Indian coast are examined.

All drawings were made by the author with the aid of a camera lucida.

## SYSTEMATIC TREATMENT OF THE GROUP.

Genus *Bankia* Gray.Subgenus *Bankia* s. str.

1. *Bankia* (*Bankia*) *bengalensis*, sp. nov.
2. *Bankia* (*Bankia*) *bipalmulata* Lamarck.

Subgenus *Bankiella* Bartsch.

3. *Bankia* (*Bankiella*) *indica*, sp. nov.
4. *Bankia* (*Bankiella*) *edmondsoni*, sp. nov.

Subgenus *Nausitora* Wright.

5. *Bankia* (*Nausitora*) *madrasensis*, sp. nov.

Genus *Teredo* Linnæus.Subgenus *Teredo* Linnæus.

6. *Teredo* (*Teredo*) *madrasensis*, sp. nov.

Subgenus *Teredora* Bartsch.

7. *Teredo* (*Teredora*) *gregoryi* Dall, Bartsch & Rehder.
8. *Teredo* (*Teredora*) *clava* Gmelin.
9. *Teredo* (*Teredora*) *rehderi*, sp. nov.

Subgenus *Zopoteredo* Bartsch.

10. *Teredo* (*Zopoteredo*) *bengalensis*, sp. nov.

Genus **Bankia** Gray, 1840.

1840. *Bankia*, Gray, *Synop. Brit. mus.*, p. 76.

The pallet consists of a series of cone-in-cone structures.

Genotype.—*Teredo bipalmulata* Lamarck.

Subgenus **Bankia** s. str.

1840. *Bankia*, Gray, *Synop. Brit. mus.*, p. 76.

The distal edges of the cones terminate in a thin membrane, which is fimbriated at the free margin. The lateral fimbriations form long awn-like projections.

Type.—*Teredo bipalmulata* Lamarck.

**Bankia** (**Bankia**) *bengalensis*, sp. nov.

(Fig. 1 a-c.)

*Occurrence*.—During January, 1954, five specimens were obtained from a log of red-cedar 4' × 6" × 3" used as a float for pomfret fishing in Mylapore, 4 miles off shore, which was in water for 3 months.

*Size*.—Shell height 6.3 mm., length 5.6 mm.; pallet's length 15 mm., stalk 6.5 mm., maximum diameter of blade—2.25 mm.; length of burrow—5.0 cms.

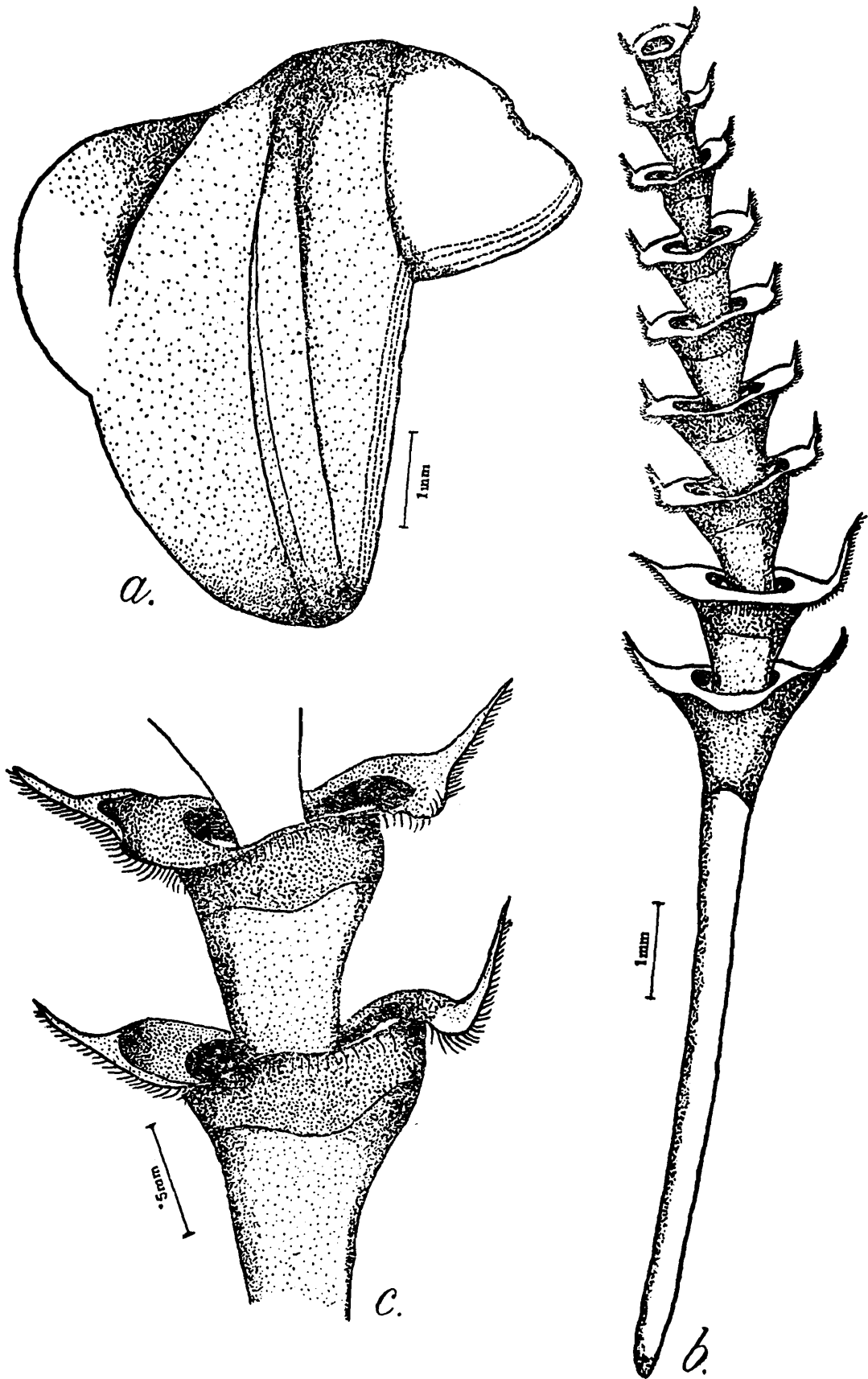


FIGURE 1.—*Bankia (Bankia) bengalensis*, sp. nov.  
 (a) Outer surface of shell, (b) Other face of pallet, (c) Two cups of the pallet enlarged to show the fimbriations of the distal margin.

*Shell*.—White and globose. The anterior part with strong sinus and thick reflected callus. The anterior part is marked by forty-eight denticulated ridges. These expand slightly fanwise from the anterior to the posterior part. The anterior median part is marked by closely arranged rows of stout denticles. These dental ridges meet the bases of those of the anterior in slightly more than a right angle. The middle median is a depressed area extending from the umbo to the ventral knob through the centre of which a shallow furrow extends for the whole length. This area is crossed by nondenticulated extensions of the dental ridges of the anterior median area. The posterior portion of the median area is almost as wide as the anterior and median part combined and is crossed by feeble extensions of a few ridges from the median portion and faint lines of growth. The auricle is well developed, thin, expanded and slightly reflected at the margin.

Interior white, with a strong umbonal knob from the base of which a slightly curved narrow flat blade, the apophysis, extends for more than half the distance from the umbone towards the ventral knob. The posterior part (auricle) projects over the posterior median part forming a narrow shelf. The lines of growth over the auricle are clear when viewed from the inside.

*Pallets*.—(Fig. 1, *b-c*.)—Long with widely spaced cone-in-cone structures forming the blade, with a cylindrical stalk shorter than the length of the blade. The joints of the blade are bell-shaped with their distal margin reflected forming a broad rim. Each joint is covered by a periostracum which is finely fimbriated on the outer free margin and projects as spinous structures at the lateral margins. The spines of one side are slightly longer than those of the other side. The distal 1/3 of the joints is coloured dark brown.

*Siphons*.—The inhalant siphon is longer and larger than the exhalant siphon and is coloured brown. In preserved specimens the inhalant siphon is twice the length of the exhalant siphon.

*Collar*.—A little enlarged.

*Burrow*.—They enter the wood cutting against the grain and after boring for about 2 cms. proceed along with the grain. The burrow is lined with a calcareous material which is thin and adherent to the wood.

*Bionomics*.—A nereid polychaete and a turbellarian were found in association with the present form. These were recovered from empty burrows. Edmondson (1942) has also recorded the presence of the turbellarian along with shipworms in Hawaii.

*Remarks*.—Though the present form clearly belongs to the subgenus *Bankia*, by virtue of the fimbriated membranes at the distal edges of the pallet joints, it does not approximate to any of the fourteen species described under this subgenus. It resembles (1) *Bankia anechoensis* Roch, (2) *B. Stutchburyi* Blainville, (3) *B. kingyokuensis* Roch, (4) *B. brevis* Deshayes in having long widely separated funnel-shaped pallet joints; but, differs from the first three species in having the outer

distal margin of the joints broad (2.25 mm.) clearly fimbriate and reflected to form a broad rim (which is almost in a level with its inner margin); and in having a stalk shorter than the blade and in having the auricle of the shell well developed. The information regarding *B. brevis* is incomplete but it is described as having a pallet 13 mm. long with few joints in which it differs from the present form. In the possession of a well developed auricle it approaches (5) *B. setacea* Tryon, (6) *B. capensis* Calman, (7) *B. bipennata* Turton, (8) *B. australis* Calman but does not belong to these species because its pallet is different from the plume-like pallet of 5, the very broad pallet of 6, and the very long one of 7, and the slender stalked pallet with close 'V-shaped' joints of 8. (9) *Bankia cucullata* Jeffreys, (10) *B. kuronunnii* Roch, (11) *B. thielei* Roch, and (12) *B. bagidaensis* Roch differ from the present form in the possession of a pallet with thick joints. The auricles of 9 and 10 are small whereas there is no information regarding this feature for 11, and the shell of 12 is unknown. (13) *B. fimbriata* Jeffreys is described as having a pallet with the joints deeply angled on the outside which is distinct from the present form and (14) *B. bipalmulata* Lamarck is different from the present form in the size of the pallet, the proportion of the stalk and blade especially in the nature of the distal border of the joints.

A detailed comparison of the present form with many of the already recorded species becomes difficult as the description available is far from complete and in many cases the shells are unknown (*B. anechoensis*, *B. bagidaensis*) or not described at all (*B. thielei*) giving no clues as to the nature of these features on which taxonomy can be properly based even for subgeneric determination. However, the present form appears unique in having a clearly distinguishable type of pallet, with widely separated bell-shaped joints with reflected and fimbriated rim; a characteristic brown colour for the distal  $\frac{1}{3}$  of the joints and in having a cylindrical stalk slightly smaller than the blade. Therefore, the present form is treated as a new species *Bankia (Bankia) bengalensis* and can be defined as follows:—

Pallet with an overall length of 15 mm. of which 6.5 mm. belongs to the stalk which is cylindrical and opaque, with eleven widely separated bell-shaped joints the outer reflected rim of which is finely fimbriated and the extreme lateral margins pulled out into pointed processes.

*Types*.—The type shall be deposited in the Zoological Survey of India (Indian Museum), Calcutta and the paratypes will be in the Zoology Laboratory, Madras.

***Bankia (Bankia) bipalmulata* Lamarck, (Fig. 2, a-d.)**

1835. *T. palmulata*, Lamarck, *Historie naturelle*, 6, p. 38.

1923. *T. bipalmulata*, Bartsch, *A Monograph of American Shipworms*, p. 7.

1931. *B. bipalmulata*, Roch & Moll, *Mitt. Zool. Staatsmst. zool. Mus. Hamburg*, 44, p. 20.

*Occurrence*.—This form has been recorded from Pondicherry by Roch (1931) and 25 specimens were collected at Madras from a log of wood (Indian red-cedar) used as a fishing float which was in water 4

miles off shore from October 17th, 1953 to January 30th, 1954 and shells and pallets from a log of wood (undetermined) washed ashore at Kovilam 20 miles South of Madras.

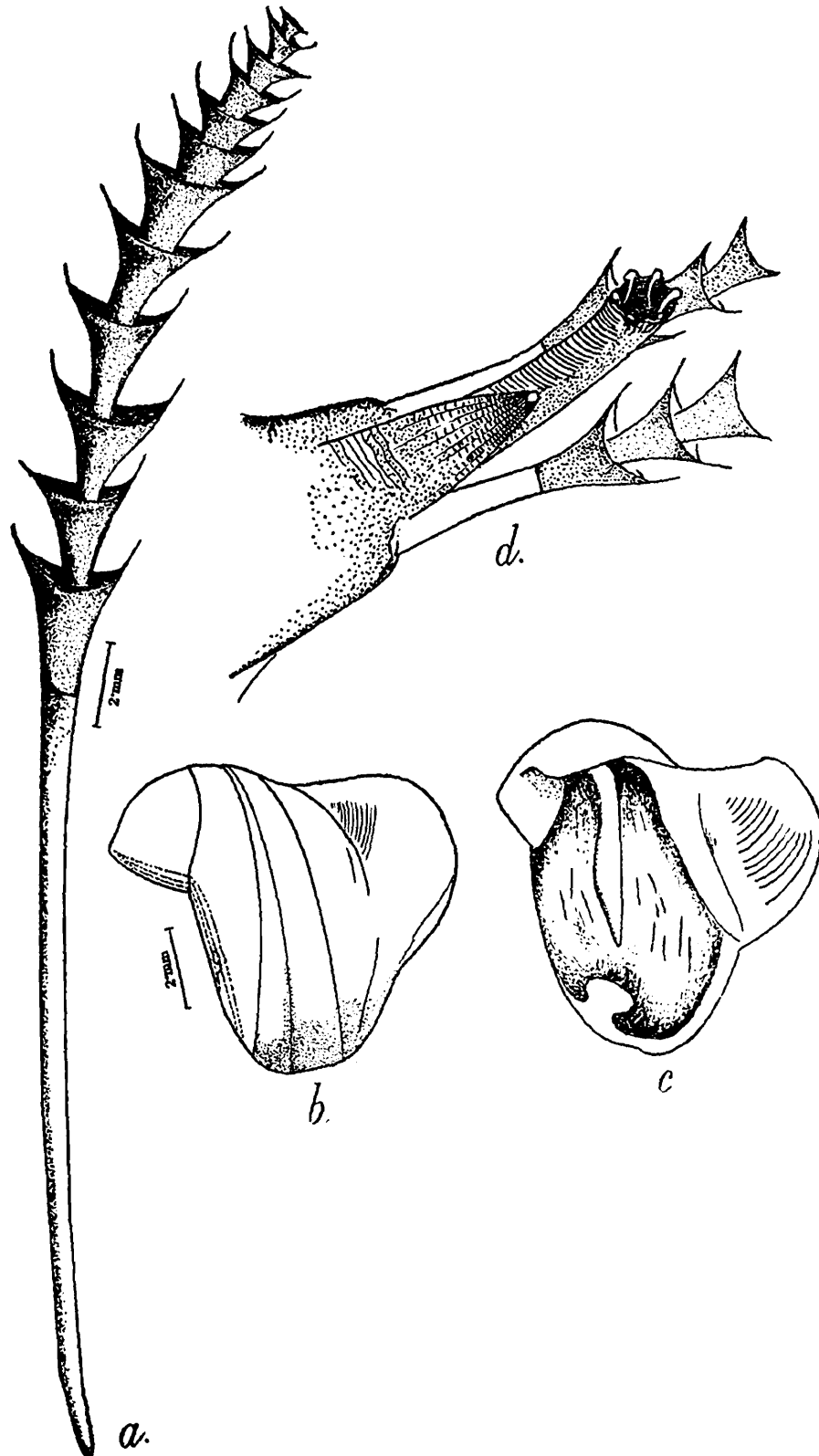


FIGURE 2.—*Bankia (Bankia) bipalmulata*, Lamarck.—

(a) Outer face of pallet, (b-c) Outer and inner faces of shell, (d) Posterior part of the body showing the siphons.

*Size.*—The largest specimen measured 19 cms. (length of burrow). Shell height—8.5 mm., Shell length—8.3 mm., Pallet length—4.5 cms., stalk—2.1 cms.

*Shell*.—(Fig. 2, *b-c*).—Sub-globular white, anterior part with usual sinus and reflected callus. The dental ridges start from this area and spread fanwise posteriorly. Fifty-five dental ridges are present with finely denticulated free margins. Anterior median broad and well defined marked by dental ridges which join those of anterior part at a little more than a right angle. The junction of anterior part with the median is a well impressed line. Middle median is shallow almost as broad as the widest part of the anterior median crossed by a number of lines of growth. The posterior median is as wide as the anterior median and is smooth and convex. Auricle is well developed, broad and high. The outer surface is not smooth and concentric lines of growth are not so well developed as on its inner surface.

Interior white, the auricle is reflected over the posterior median as a narrow strong shelf. The umbo forms a strong knob from the basal portion of which the flat blade extends about  $\frac{2}{3}$  across the inside of the shell. The ventral margin of the median part bears a strong knob.

*Pallets*.—(Fig. 2, *a*).—Long, provided with twelve well formed widely spaced, cone-in-cone elements or cups. The cones are covered with a thin layer of yellowish brown periostracum. The outer margins of cups are more concave than the inner margins. Lateral borders of cups are drawn out into long processes.

*Siphons*.—(Fig. 2, *d*).—Inhalant, wide and coloured dark brown especially its interior, with six longitudinal, white, thickened patches. The rim of the siphon is reflected resembling a tulip. The exhalant is shorter, narrower, and free.

*Collar*.—A little enlarged and its rim is slightly thickened.

*Burrow*.—Lined with a thin shelly material which is not very brittle due to traces of a horny material, with transverse septa near the opening of the burrow.

Their presence inside the wood is easily detected by the protruding pallets.

*Remarks*.—The information regarding the shell characters of this form is incomplete. A close scrutiny of the figure of the pallet given by Roch and Moll (1931) and a comparison of the descriptions available show that this form is identical with *Bankia bipalmulata* Lamarck.

#### Subgenus **Bankiella** Bartsch, 1921.

1921. *Bankiella*, Bartsch. *Proc. Biol. Soc. Washington*, 34, p. 26.

Pallets consisting of a series of cone-in-cone elements covered by a thin membrane which is neither fimbriated nor denticulated at the free margin, but entire.

*Type*.—*Bankia (Bankiella) mexicana* Bartsch.

#### **Bankia (Bankiella) indica**, sp. nov. (Fig. 3, *a-d*).

*Occurrence*.—Nearly six hundred individuals of this species were collected from wooden buoys employed in pomfret fishing along the Madras coast. They were also obtained from drift logs cast ashore and

from old country rafts discarded as not seaworthy. Test blocks of red cedar that have been submerged off Mylapore also were heavily attacked by this species. This species is one of the dominant species of shipworms in Madras. Timber blocks exposed to sea water for more than two months get heavily riddled by this shipworm and are thoroughly honeycombed in about six months.

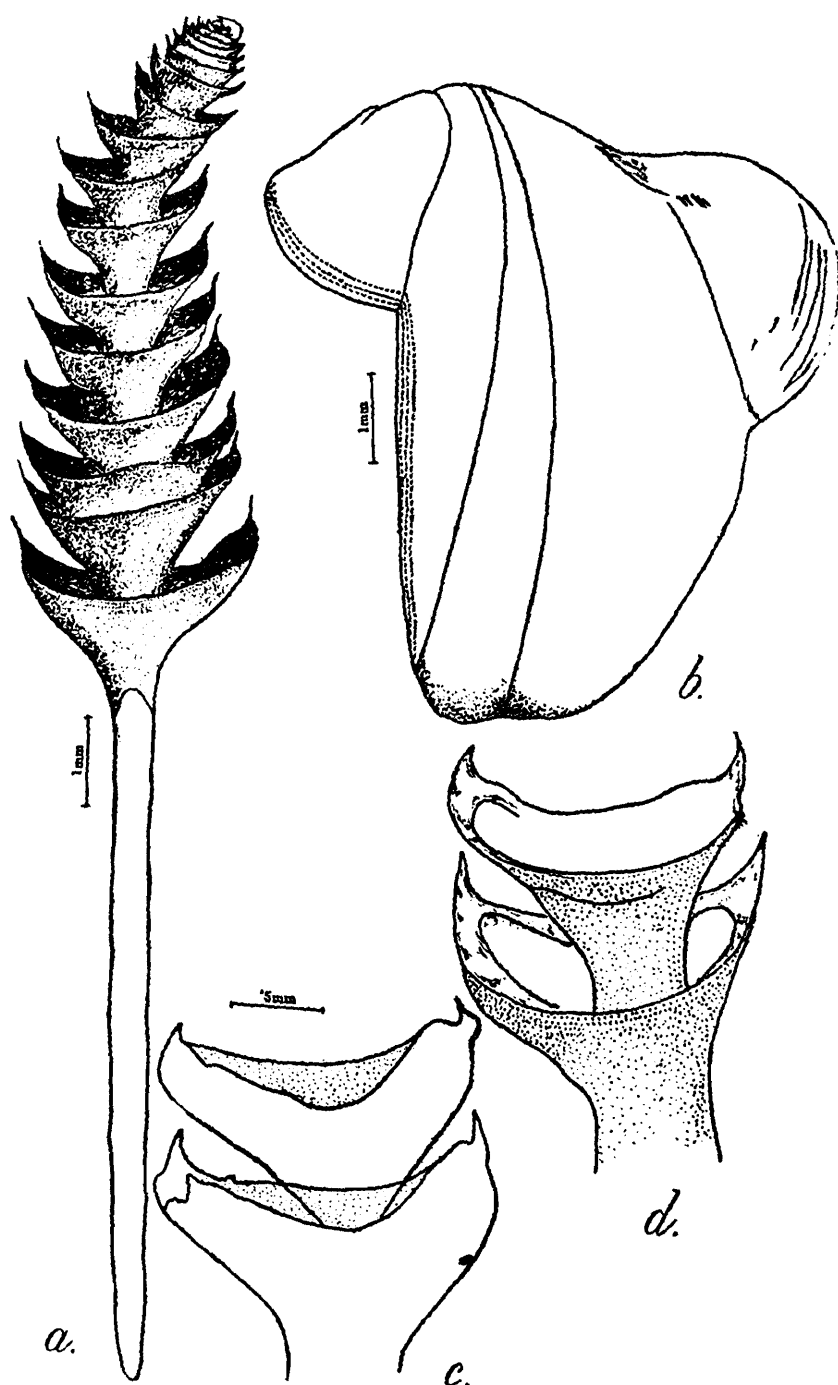


FIGURE 3.—*Bankia (Bankiella) indica*, sp. nov.

(a-b) Outer faces of pallet and Shell respectively, (c-d) Inner and outer faces of two 'cups' of the pallet enlarged.

*Size.*—The maximum size of a specimen I have recovered from a timber block was 28 cms. Shell length 6.6 mm., height 7.6 mm. Pallet length—16.8 mm., stalk length 8.3 mm.

*Shell.*—(Fig. 3, b.)—Globular in natural contact. Shell except for the auricle and posterior median part, has a light rosy flush. The extreme anterior portion with a deep sinus from which a smooth callus is reflected



over the anterior dental ridges. The height of anterior part is more than its width. Forty dental ridges with fine denticles at their free margin are present in the anterior region which are separated by spaces twice as wide as the dental ridges. The junction of the anterior portion with the anterior median is a well defined groove. The anterior median is marked by very closely set and regularly arranged dental ridges bearing denticles which are stouter and stronger than those of the anterior area. They meet those of the latter in a little more than a right angle. About fortythree dental ridges are present but some have been eroded at the umbonal end. The middle median part is smooth, bearing a few non-denticulated upturned extensions of the dental ridges of the anterior median area towards its ventral side. The posterior median portion is broader than the anterior median and middle median taken together. This region is thick, convex, and marked by feeble oblique lines of growth. This region slopes steeply down before forming the well developed auricle. In outline the auricle joins the posterior median portion in an even concave curve and is marked by curved lines of growth. The auricle is thin at the edges and slightly reflected outwards at the margin.

Internally the shell shows a tumid area at the junction of the anterior and median parts. The umbo marks a very strong knob from the underside of which a broad sickle shaped apophysis projects into the cavity of the shell parallel to the middle median part in such a way that the plane of the blade is at right angles to that of the shell. The extreme ventral part of the median part is provided with a strong knob. The inside of the auricle shows translucent chord-like lines. The posterior part projects as a shelf into the cavity of the median part at the junction of the auricle.

*Pallets.*—(Fig. 3, *a, b, c.*)—Cone-in-cone type joints, plainly funnel shaped and clearly separated, distal margin completely free and entire. The blade in the type consists of sixteen well spaced funnels or cups the rims of which are covered by a thin, light brown, periostracum which is drawn out into pointed processes laterally. Outer margin of the funnel more concave than inner. The outer side of blade is convex and inner side flat. The stalk is long and cylindrical.

*Siphons.*—In formalin preserved specimens the inhalant siphon is wider and longer with brownish spots. The exhalant siphon extends upto about  $\frac{3}{4}$ th of the length of the inhalant siphon. Their rims are beset with small tentacles.

*Collar.*—Slightly developed.

*Burrow.*—With fairly thick calcareous tubing, which fall off easily from the wood when dry.

*Bionomics.*—The young ones were found to be invariably males. These pass into a female phase through a brief hermaphrodite stage. Gonads of many forms were infested with dicyemids in different stages of development. A polychaete worm and a turbellarian are frequently found in association with these shipworms.

*Remarks.*—The subgenus *Bankiella* which is distinguished from other subgenera by the margins of the pallet joints being entire, includes ten species. A comparative study of the descriptions of these suggests that the present form does not belong to any one of them. It resembles (1) *Bankia gouldi* Bartsch, (2) *B. segaruensis* Roch, (3) *B. mexicana* Bartsch, (4) *B. odhneri* Roch, in the possession of a well developed auricle, but differs from (1) in the relative proportions of the posterior median part with middle median and anterior median. In the present form the posterior median is more than anterior median and middle median combined, whereas in *Bankia gouldi* it is equal to the other two parts put together. Again the pallet is described as plumose in that form, with a horny film bridging the gap between the free ends of one cone to the body of the next, unlike the present form. The inner side of the pallet is deeply concave in *B. segaruensis*, while the shell length is more than shell height in *B. mexicana*. *B. odhneri* is distinguishable in having a lanceolate blade covered with strong film and long thorus on the sides. In having clearly separated joints with short thorns it approaches *B. brevis* Deshayes, *B. carinata* Gray and *B. oryzaformis* Sivickis but does not belong to these species because of the presence of nineteen joints for the blade when the length is 8.5 mm. and an overall pallet length of 16.8 mm. Again in *B. oryzaformis* the auricle is small. *B. companellata* Roch, is clearly different in having only six to eight bell shaped joints for the pallet. *B. minima* Balinville which has a pallet 10 mm. long with 12 to 20 joints and *B. pennaanseris* which has 'goose-quill'-like pallet with outer side 'V shaped' and inner side scaly are different from the present form. In view of these differences, the present form is treated as a species new to science: *Bankia (Bankiella) indica* and can be defined as follows:—shell length less than shell height, with width of posterior median greater than anterior median and middle median put together, with well developed auricle, 40-45 ridges on shells of length 6.6 mm. and height 7.6 mm. (average of seven specimens). The pallet on an average, with nineteen units for the blade with a length of 8.5 mm. with the stalk measuring 8.3 mm. and an overall length of 16.8 mm. with joints of the pallet blade well spaced and funnel-like, with yellowish-brown periostracum forming a smooth entire margin, which is drawn out into short pointed processes at the lateral margins.

***Bankia (Bankiella) edmondsoni*, sp. nov.**

(Fig. 4, a-e.)

*Occurrence.*—Thirteen specimens were taken from a drift log of *Bamboosa* cast ashore on Madras Beach on December 17, 1953. Another lot of six specimens was recovered from a small teak (*Tectona* sp.) plank. A third lot of 5 specimens from a drifting palm leaf (*Borassus* sp.). All were alive and their pallets visibly protruding through the minute openings. A specimen of 4 cms. long with ripe gonadial contents has been selected as the type of the species.

*Size.*—Shell length—4.0 mm., height—4.3 mm., Pallet length—4 mm., stalk—2.3 mm.

*Shell*.—Subglobular, thin, height more than length, anterior portion large, broader than the middle and posterior area (auricle) taken together, bearing about 70 dental ridges which bear fine denticles at their free margin. This part is considerably wider than high, projecting fairly deep into the median portion. The dental ridges start from the callus and take a smooth curve and pass posteriorly parallel to the ventral margin of the anterior lobe. They are of regular width and spacing. The dental ridges of the anterior and median part meet at an acute angle, especially at the ventral side. Towards the umbo they meet almost at right angles. The anterior median part is broad bearing dental ridges arranged

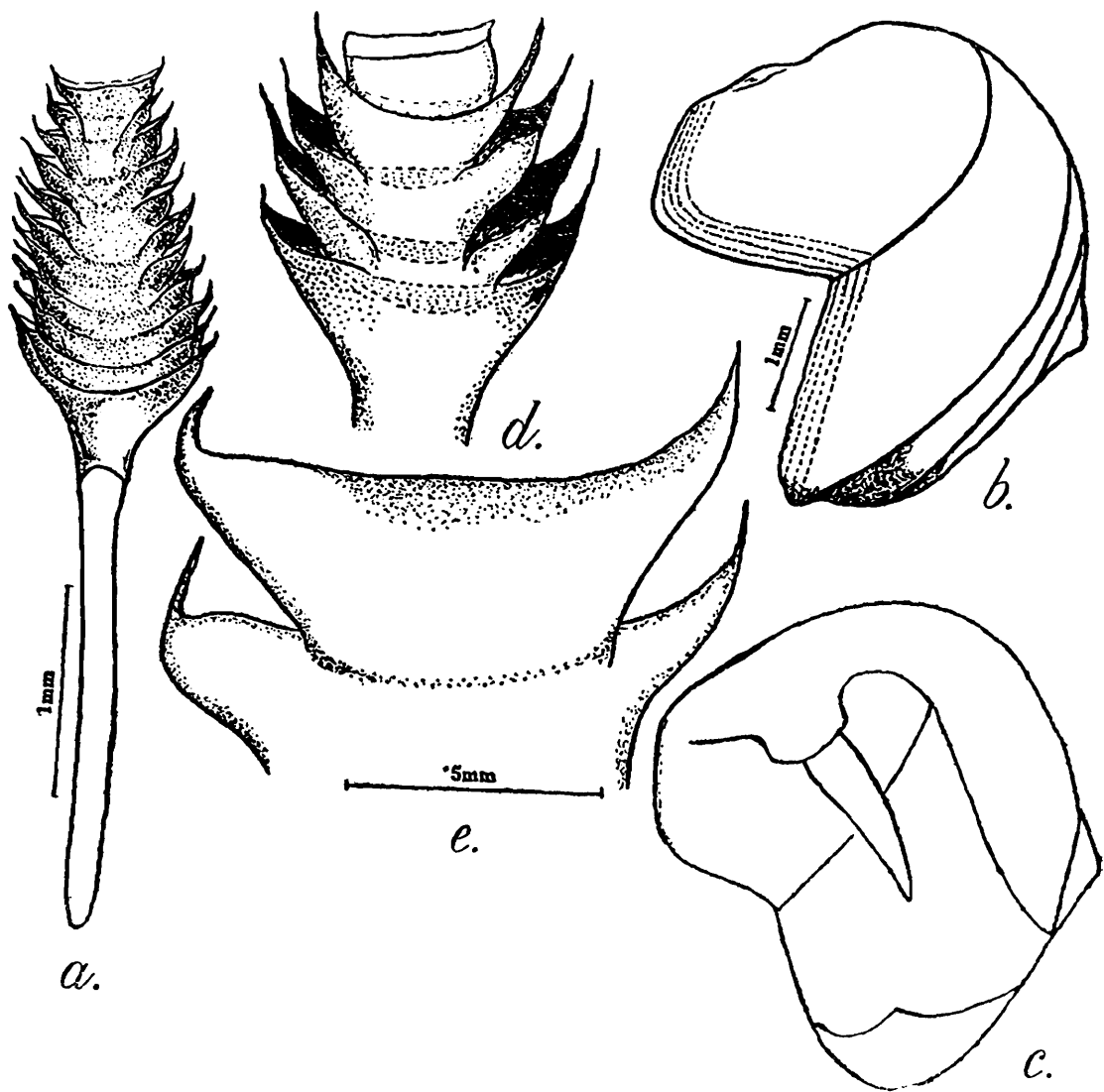


FIGURE 4.—*Bankia (Bankiella) edmondsoni* sp. nov.

(a-b) Outer faces of pallet and shell respectively, (c) Inner face of shell, (d) Outer face of the distal end of the pallet showing the first formed cups, (e) Inner face of two basal cups.

very closely, with denticles stronger than those of the anterior portion. This region, in addition to the dental ridges, show transverse wrinkles. The dental ridges extend into the middle median as non-denticulated strong curved lines, and proceed backwards into the posterior median. A shallow groove extends from the umbo to the ventral articulating knob in the middle median area. The posterior median is narrow, and is produced into a short auricle, having the shape of an equilateral triangle (Fig. 4, b-c).

Viewed from within, the impressions of the dental ridges are visible due to thinness of the valves, especially with transmitted light. From the base of the umbonal knob is pendant the apophysis, which is broad and flexed into the cavity of the shell.

*Pallets*.—(Fig. 4, *a*, *d*, *e*).—Cone-in-cone type. Cones, arranged compactly overlapping one another, with the lateral margin drawn out into spinous projections. The stalk is cylindrical, long and opaque, the blade is broadest at the proximal part tapering distally. Pallet of the type specimen, 4 mm. long (dist. end of blade slightly imperfect), with a blade of 1.7 mm. provided with 11 joints closely arranged. Each joint of the blade has its distal part covered by a light-yellow periostracum which is entire.

*Siphons*.—In living specimens, exhalant and inhalant siphons are of equal length, the latter wider with a trumpet-like tip. It measures 7 mm. in a specimen 38 mm. long.

*Burrow*.—With calcareous lining.

*Remarks*.—The anterior and anterior median lobes combined of the shell of this form is so large as to constitute nearly 86 per cent of the total length of the shell, of which the anterior lobe alone constitutes 60 per cent. In this feature, it is clearly distinct from all the other eight species described or figured under the subgenus *Bankiella* so far,\* whose dimensions are available or determinable from figures drawn to scale. In *Bankia triangularis* Sivickis the anterior, and anterior median lobes are wide, the latter being about 1.5 times the rest of the median and auricle combined, and the posterior median is very narrow with an auricle small or lacking. In these features the form resembles *B. triangularis*, though it differs in the outline of the shell. The description of the pallet of *B. triangularis* is incomplete and gives no clue as to the nature of the features on which taxonomy could be properly based. However, a scrutiny of the photograph shows the following differences:—(1) Joints of the blade are more compactly packed in *B. triangularis*, (2) Length of stalk is less than the length of the blade. Therefore the present form is treated as a new species: *Bankia (Bankiella) edmondsoni* and can be defined as follows: Thin shell with height more than its width, having broad anterior and anterior median lobes, which form nearly 86 per cent of the total length, and with an auricle which is very small like an equilateral triangle, and pallet with a stalk longer than the blade, the latter having eleven joints when it is 1.7 mm. long. (*edmondsoni*, to Dr. Charles Howard Edmondson for his work on shipworms).

#### Subgenus *Nausitora* Wright, 1865.

1865. *Nausitora*, Wright, *Trans. Linn. Soc.* Vol. 24, p. 51, pl. 46.

Pallets consisting of a series of cone-in-cone elements which are not entirely free at their distal ends but fused on the exterior surface, where some shelly material and a thick periostracum cover the entire pallet.

*Type*.—*Bankia (Nausitora) dunlopei* Wright.

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\* 'The Tereidinidae of the Soviet Union' (Roch, F. 1934) was not available to the author who, therefore, has not been able to discuss the similarities and differences of form he has described, with the Soviet Tereidines.

***Bankia (Nausitora) madrasensis*, sp. nov.**(Fig. 5, *a-d*.)

*Occurrence*.—Two specimens have been collected from an exposed Catamaran\* of Maruthu† timber at Royapuram beach on 10th July, 1953. One of these has been selected as the type. A second lot of 4

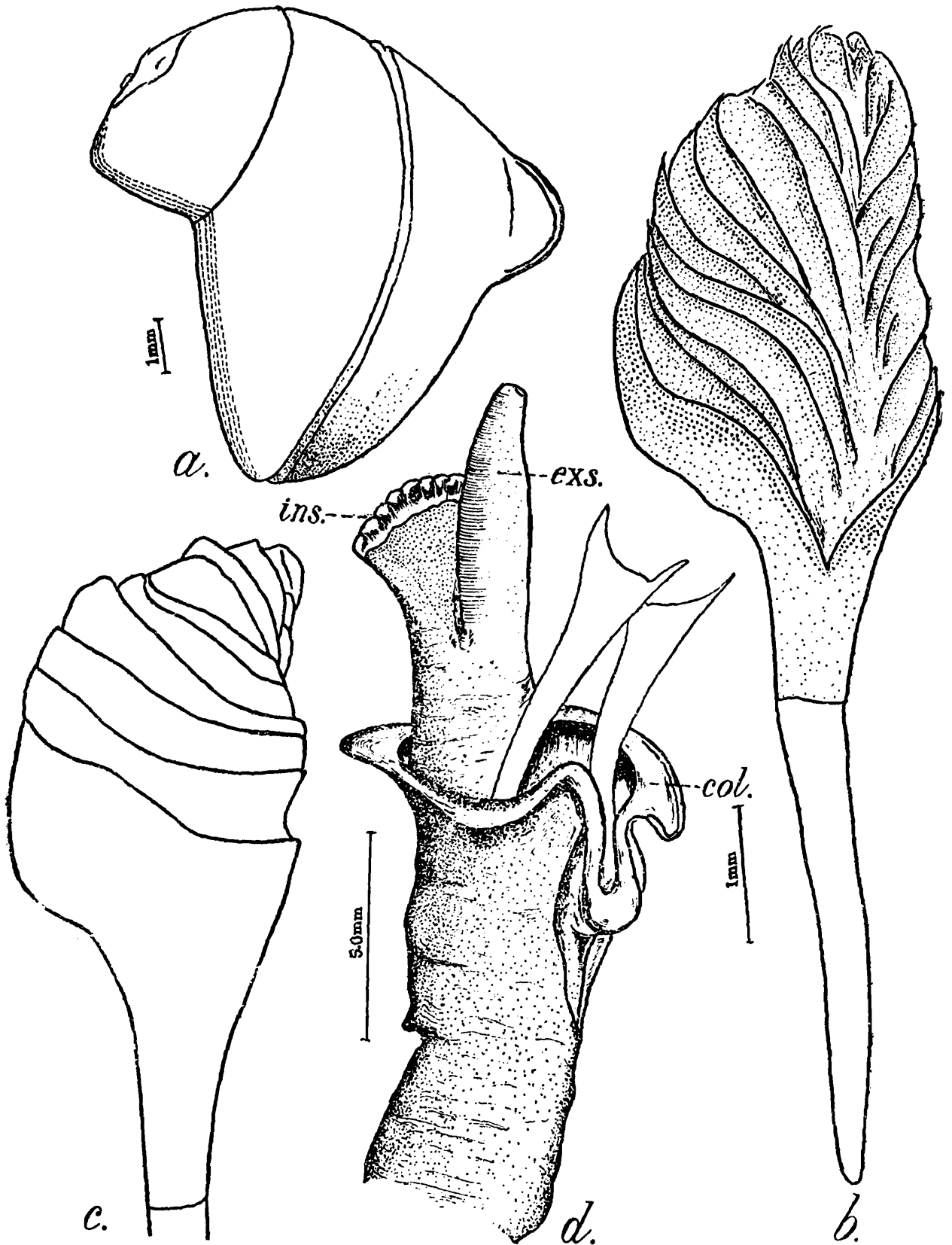


FIGURE 5.—*Bankia (Nausitora) madrasensis*, sp. nov.

(*a*) Outer face of shell, (*b*) Outer face of entire pallet, (*c*) Inner face of the blade of pallet, (*d*) Posterior part of the body showing collar and siphons.

Col—Collar. Ins—Inhalant siphon. Ex. S.—Exhalant siphon. P.—pallet. (Blade not fully shown).

\* Country log raft.

† *Terminalia* Sp.

specimens was obtained from another Catamaran of the same timber from Triplicane beach.

*Size.*—Length of specimen—12 cms. Shell height—9 mm., length—9 mm., Pallet length—8.5 mm., stalk—4.5 mm. Maximum diameter of blade—2.3 mm.

*Shell.*—Subglobular with light brownish flush. The anterior part with about 100 closely spaced finely denticulated ridges. The line of junction between anterior and anterior median is a well marked concave line. Anterior median portion broad and is marked by more than hundred strongly denticulated closely packed dental ridges which join the dental ridges of the anterior part at a little more than a right angle. Curved nondenticulated ridges which are extensions of the dental ridges of the anterior median area cross the surfaces of the middle and posterior median areas. The anterior median area is broader than the middle and posterior parts taken together.

The middle median area is narrow, shallow and coloured dirty brown and its central part is marked by a groove. The extreme ventral part of the median part bears the usual knob. The posterior median area forms a small auricle at its posterior part, which is considerably eroded and the surface of which is crossed by feeble lines of growth. There is a deep furrow internal to the margin parallel to the outline of the auricle.

Internally the auricle forms a very narrow shelf. The apophysis is flat and broad at the middle.

*Pallets.*—(Fig. 5, *b-c.*)—Ovate, with a cylindrical stalk which is longer than the blade. The base of the blade is solid, the distal  $\frac{2}{3}$  consists of cone-in-cone elements closely packed, covered by a periostracum of brownish hue. The inner side of the solid portion is slightly concave, and that of the distal part is marked by cross lines marking the joints of the blade.

*Siphons.*—(Fig. 5, *d.*)—The inhalant siphon is wider but shorter than the exhalant siphon, being nearly  $\frac{1}{2}$  its length. Its rim is wavy. The siphons and pallets emerge out through a prominent muscular collar, (a cup-like growth of the mantle) the rim of which is rolled out (Fig. 5, *d*, Col.).

*Burrow.*—The calcareous tubing very thin and in the specimens collected on 10th July 1953 there was no trace of it.

NOTE.—Three specimens, when brought alive to the laboratory and kept in a bowl of sea water ejected gonadial elements.

*Remarks.*—In the possession of a pallet which is ovate and an auricle which is narrow it resembles *B. (N.) braziliensis* Bartsch, *Bankia globosa* Sivickis, *B. quadrangularis* Sivickis, but differs from the first, in that the

anterior median part of the shell is considerably wider than the middle median and post-median combined, and in having a shell, whose height is equal to its width, unlike that form in which the shell height is more than shell width (6 : 5·8) and in having a pallet blade whose length is more than its diameter, without a thin calcareous deposit. It differs from 2nd and 3rd in the relative proportions of the anterior median with the middle and post-median combined, and in the details of the pallet structure. Further, the present form approaches closely *Nausitora messeli* Iredale, in having a shell the height of which equals its length, with a broad anterior median area and an eroded small auricle, but differs from it in having 100 denticulated ridges on anterior lobe instead of 30 as in that form. These differences are further augmented when the pallets are compared. In *Nausitora messeli* the pallet is 21 mm. long, of which only 1·6 mm. belongs to the stalk and the blade is narrower (width 1·2 mm.) and elongate and not ovate as in the present form.

A detailed comparative study of the present form with the other seventeen forms, assignable to the subgenus *Nausitora* by virtue of the fused nature of the pallet joints, shows that the present form is different, and does not correspond to any described so far, and hence is treated as a new species *Bankia (Nausitora) madrasensis* and can be defined as follows :

Shell height, equivalent to shell width, with anterior median much more wider than the middle median and posterior median combined, with a small auricle and having a pallet with a long stalk and ovate blade, whose length is more than its diameter, formed of closely packed units covered over by a brownish periostracum.

*Types*.—The holotype will be deposited in the Indian Museum and the paratypes will be in the Zoology Laboratory, Madras.

#### Genus *Teredo* Linnæus, 1758.

1758. *Teredo*, Linnæus, *Syst. Nat. ed. 10*, p. 651.

Pallets are either paddle or spoon shaped. They may be distally cupped or not, or they may even bear a calcareous knob at the terminal portion.

*Genotype*.—*Teredo navalis* Linnæus.

#### Subgenus *Teredo* Linnæus.

1758. *Teredo*, Linnæus, *Syst. Nat., ed 10*, p. 651.

*Teredo* has the pallets paddle-shaped, with a decidedly cup-shaped depression at the distal end. The distal portion is covered with a dark periostracum, which terminates in the shape of two lateral horns.

*Type*.—*Teredo navalis* Linnæus.

#### *Teredo (Teredo) madrasensis*, sp. nov.

(Fig. 6, a-c.)

*Occurrence*.—Two specimens were obtained from a fish float of red cedar from Mylapore coast on 14th January 1954. One of these has been selected for the type specimen. Another lot of seven specimens

was obtained from a plank of *Mangifera* species from Kayankulam backwaters in Travancore on 20th January, 1954, and sent to me by Shrimati Gomati Nair.

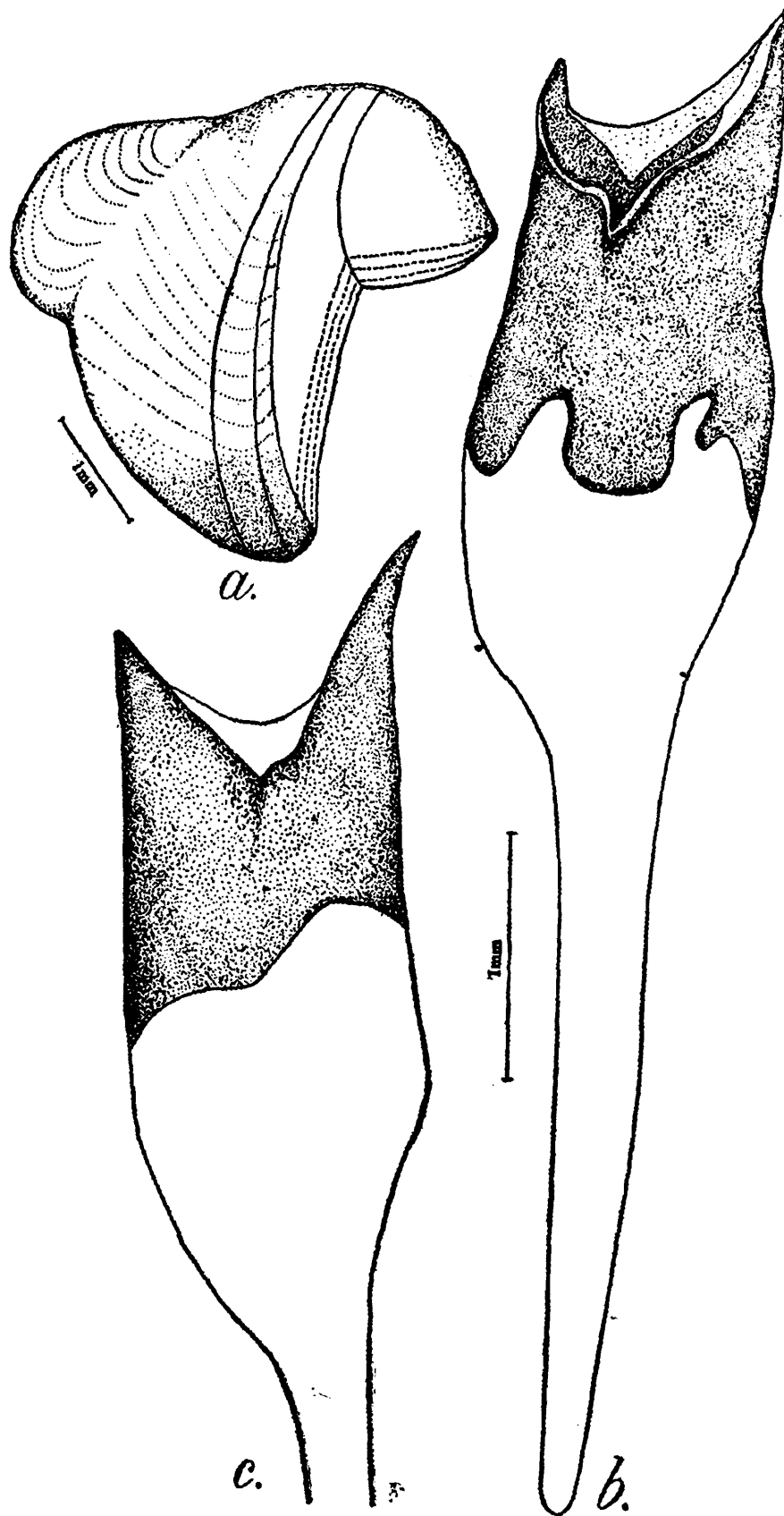


FIGURE 6.—*Teredo (Teredo) madrasensis*, sp. nov.

(a-b) Outer faces of shell and pallet respectively, (c) Inner face of the blade of pallet.



*Size*.—5.5 cms. long. Shell-height—4 m.m., Length—4 mm., Pallet length—6.3 mm., stalk—3.3 mm., Maximum diameter of blade—1.3 mm.

*Shell*.—(Fig. 6, *a*.) Sub-globular, white. The anterior part with a deep sinus, and callus. The latter reflected postero-dorsally over the dental ridges. The dental ridges numbering 27 are spread fanwise posteriorly from the callus and are separated by spaces about twice as wide as the ridges at the ventral side of the anterior area. The dental ridges are finely denticulated at their free margin. The dental ridges of the anterior part meet those of the anterior median at almost right angles. The anterior median portion is narrower than the auricle or the posterior median, and bears about thirty ridges which are closely crowded, bearing stout denticles arranged in a regular row. The middle median is a narrow area, with a furrow extending from the umbo to the ventral knob, and is crossed by enfeebled non-denticulated extensions of the dental ridges, which are further extended into the posterior median portion. The latter is broader than the middle median and anterior median combined. The surface of this area is white and smooth, but for the feeble extensions of the dental ridges. This portion forms a strong auricle, the latter bearing on it concentric lines of growth.

Interior white, the anterior and median parts smooth, the middle median clearly demarcated with a ridge in the middle. The shelf very narrow, projecting into the cavity of the posterior median. The lines of growth are prominent on the inside as well. The apophysis is given off from the ventral side of the dorsal knob. It is flat, tapering towards the end, extending for more than half the distance into the cavity of the shell.

*Pallets*.—(Fig. 6, *b-c*.) With stalk longer than the blade, and cylindrical, gradually becoming broader towards the blade. The blade has a calcareous basal portion capped at the distal end by a well developed elongated black periostracum, which forms about  $\frac{2}{3}$  the length of the blade. It is cupped distally. The outer free border of the cup is more concave and is produced into horns laterally. The stalk at its base is surrounded by a fold of the mantle forming a collar.

*Siphons*.—The exhalant siphon is narrower and shorter than the inhalant siphon, being only half its length in formalin preserved specimens.

*Collar*.—A muscular collar is well developed in this form at the base of the pallets.

*Burrow*.—With a thin lining of calcareous matter forming a tube which is adherent to the wood.

*Remarks*.—A study of the figures and descriptions of 130 species recorded under the genus *Teredo* shows that thirty species undoubtedly belong to the subgenus, *Teredo* of Bartsch (1922), of which four species approach closely the present form, namely, *Teredo navalis* Linnæus, *T. furcillatus* Miller, *T. parksi* Bartsch, and *T. pocilliformis* Roch. The form resembles the figure of the shell of *T. navalis*, as given by

Jeffrey, in the number of ridges for the anterior lobe, but differs from it in having the same number for the anterior median also instead of fifteen ridges as shown in the aforementioned figure. In the present form, the pallet has an overall length of 6.3 mm. of which 3.3 mm. belong to the stalk, whereas the pallet of *Teredo navalis* has a stalk shorter than the blade, and the proximal end of which is slightly swollen and bent, unlike the present form in which it is straight and tapering. *Teredo furcillatus* is different as its anterior part is higher than broad, unlike this form in which it is broader than high. The pallet of *Teredo furcillatus* has a stalk which is long with a small blade, while in the present form it is significantly different. Stalk—3.3 mm., blade—3 mm. The proportion of the shell and pallet is also different. The overall length of the pallet is 3.7 mm. when the shell is 3 mm. high and 3.4 mm. long in that form. The absence of a dark periostracum is another distinctive feature of the pallet of *T. furcillatus*. *Teredo parksi* is different in the possession of a small auricle, which according to Miller, is a character which exhibits less variability in this species. The pallet is with a long stalk and a short deeply excavated blade, unlike in the present form. The information about *T. pocilliformis* is incomplete but appears to be different from this, as its pallet is described as resembling that of *T. navalis*, with the distal excavation deeper and cup-shaped. The present form appears to be new and can be defined as follows:—

Shell in which the anterior lobe is broader than high, with a well developed auricle, with the anterior median and middle median bearing each about 30 dental ridges, when the shell is 4 mm. high and 4 mm. long, pallet with a straight stalk longer than the blade, the distal 2/3 of the latter being covered by a black periostracum which is cupped distally, the outer free border of which is more concave and produced into two projections laterally.

*Types*.—The holotype will be deposited in the Indian Museum, Calcutta, and the paratypes in Zoology Laboratory, Madras.

#### Subgenus **Teredora** Bartsch, 1921.

1921. *Teredora*, Bartsch., *Proc. Biol. Soc. Washington*, Vol. 34, p. 26.

The auricle in this subgenus is placed upon the posterior median portion, that half of it projects as a shelf inwardly, and the other half outwardly. The pallets have a nail-like depression which may be marked by concentric lines of growth, or these may become even rib-like and it may have longitudinal radiating riblets, confined to the basal portion of the nail-like part or these also may be strong and rib-like.

*Type*.—*Teredo malleolus* Turton.

#### **Teredo (Teredora) gregoryi** Dall, Bartsch, and Rehder.

(Figure 7, a-d.)

1938. *Teredo (Teredora) gregoryi*, Dall, Bartsch, and Rehder, *B. P. Bishop Mus. Bull.* 153, pp. 212, 213, pl. 55, figs. 1-5.

1942. *Teredo (Teredora) gregoryi*, Edmondson, *B. P. Bishop Mus. Occ. Papers* 17 (10), pp. 127, 129, figs. e to i.

*Occurrence.*—Drift logs washed ashore on Madras beach during December-January, and wooden structures and fishing floats exposed to sea water in this locality, are infested with this shipworm in large numbers. The maximum length of the specimen I have collected is 29 cms. from Indian red-cedar. As has been reported for the Hawaiian species by Edmondson, young specimens have thick bodies as compared with their length. A specimen 20 cms. long has been selected as the type for description.

*Size.*—Shell height—9.8 mm. Length—8.8 mm. Pallet length—8.6 mm. Stalk—2.1 mm. Maximum diameter—4.1 mm.

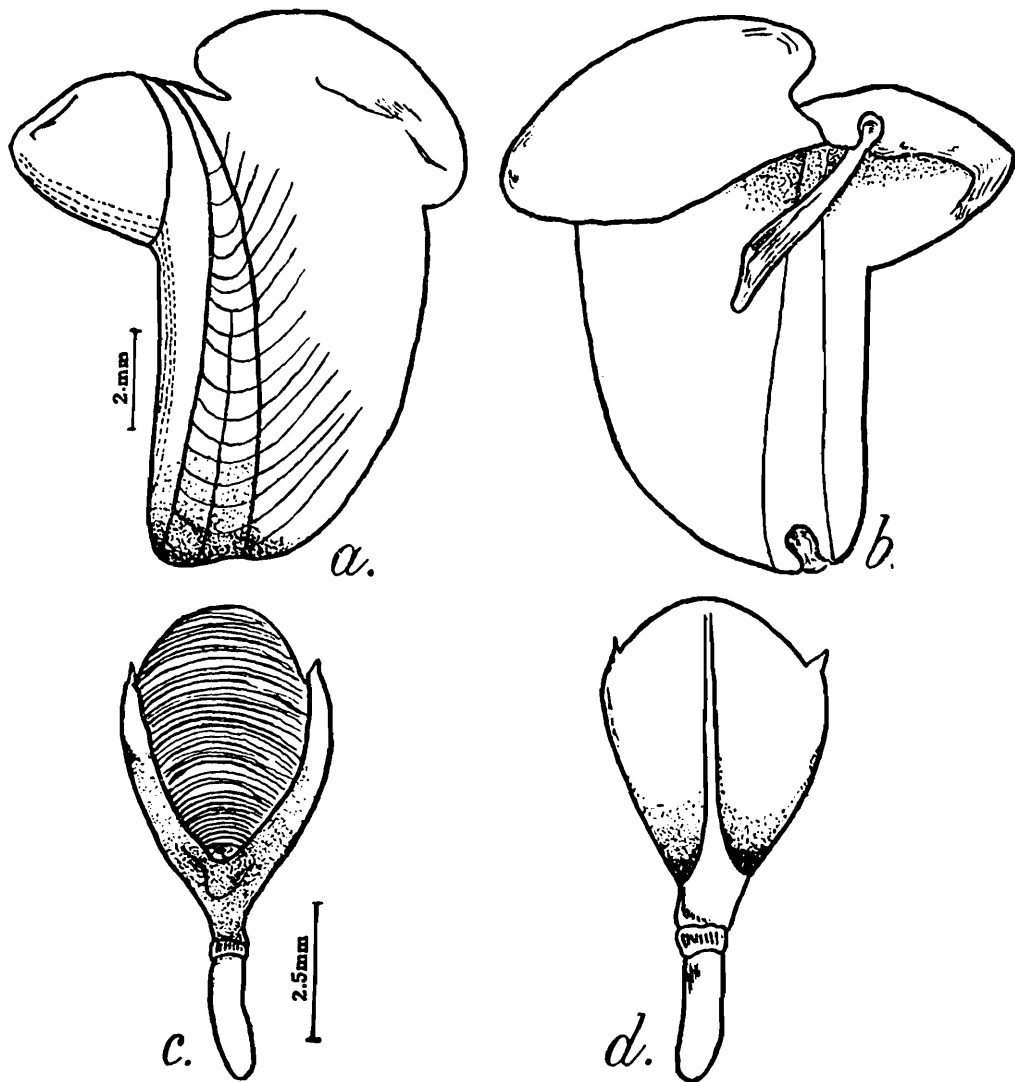


FIGURE 7.—*Teredo (Teredora) gregoryi*, Dal, Bartsch, and Rehder.  
(a-b) Outer and inner faces of shell respectively, (c-d) Outer and inner faces of pallet respectively.

*Shell.*—(Fig. 7, a-b.) Large and white, anterior lobe with sinus and reflected callus and thirty dental ridges radiating backwards from the callus. At the post-extremity the dental ridges are separated by spaces about twice as wide as themselves. Anterior median area is marked by closely-spaced denticulated ridges that join those of the anterior part at a little more than a right angle. The middle median part is concave and is further marked by a depressed groove, and is crossed by curved nondenticulated extensions of the dental ridges of the anterior median

region, and also by strong lines of growth. These make the surface of this region rough. The posterior median part is wider than the anterior median and middle median parts taken together, and is placed obliquely on the posterior median portion, about  $1/3$  projecting as a shelf inwards and  $2/3$  outwards, with its free border curving upwards, creating a broad concavity on the external surface.

Viewed from within, the anterior and median portions are joined by a slender suture. The dorsal and ventral knobs are very prominent. The whole interior is smooth except for the auricle, where prominent concentric lines of growth are perceivable. Pendant slightly obliquely from the umbonal region is the narrow flat apophysis, the flat surface being parallel to the shell.

*Pallets*.—(Fig. 7, *c-d*.) Spatulate, with a short cylindrical stalk which is slightly curved at its proximal part. The junction of the stalk with the blade is marked by a ring-like prominence. The outer surface of the blade resembles a finger nail in its nailbed. The nail-like median portion is marked by rough concentric lines. The inner palletal surface is smooth and shows a rib running through its centre very much as if the stalk portion is extended towards the tip through the pallet.

*Siphons*.—In formalin preserved specimens the siphons are almost of equal length, fringed with tentacles at the rim.

*Collar*.—Slightly developed.

*Burrow*.—Lined by calcareous material which forms a thick tubing.

*Remarks*.—This form agrees with the figures and descriptions of *Teredo (Teredora) gregoryi* by Dall, Bartsch, and Rehder (1938) and also the specimens of the above form from Hawaii, sent to me by Dr. Edmondson for comparison, especially in having a very prominent obliquely placed auricle which is curved upwards at the free border and when viewed from within is seen projecting as a shelf  $1/3$  inward and  $2/3$  outwards. The pallets are also identical being spoon-shaped, the stalks being short which merge with the matrix of the expanded blade, on the inside of which it appears as a strong crest. In both, the inside of the pallet is smooth and on the outside the nail-like area is marked by concentric lines. However, the present form possesses two small spinous projections at the distal margin of the pallet laterally. The denticles of the shell also vary in the two forms when they are examined under an oil immersion lens. This feature alone is not a very reliable factor. "Sometimes species which are known to be different have denticles quite similar."\*

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NOTE.—While the typical form of the species has been recorded from various localities in the Pacific ocean, such as, Olowalu (Thaanum), Hæna, Kauai (Bryan), Hauula, Oahu (Edmondson), Johnston island and Wake island (Thaanum), this species has not been recorded hitherto from the Indian ocean. Hence the occurrence of this form here is of special interest and shows the remarkable range of distribution of this species of ship-worms. Their ready appearance in fair numbers in test planks suggests that this species is a well established one in Madras waters.

\* Edmondson—personal communication.

**Teredo (Teredora) clava** Gmelin (Fig. 8, a-c).

1817. *Teredo clava*, Dillwyn, Descriptive catalogue of recent shells, 2, p. 1088.

1931. *Teredo clava*, Roch and Moll. *Mitt., Zool. staatsinst. Zool. Mus. Hamburg*, p. 8.

*Occurrence.*—This form has been recorded from Madras by Gravely (1941). Eleven specimens have been collected from the floating corky seeds of the mangrove *Carapa moluccensis*.

*Size.*—Shell height—7 mm., length—4.5 mm., Pallet length—7 mm., stalk—2 mm., maximum diameter of blade 2.6 mm.

*Shell.*—Very short with median part elongated and covered by a periostracum which is dark brown over the anterior and anterior median parts. The anterior portion with the usual sinus and reflected callus. The dental ridges that radiate from the callus area proceed backwards in a gentle even curve. Thirteen such ridges are present, the first three ridges parallel to the ventral edge are arranged closely, the next four above them are wide apart and stand out as strong lamellae, finely denticulated at their free border. These dental ridges are continued

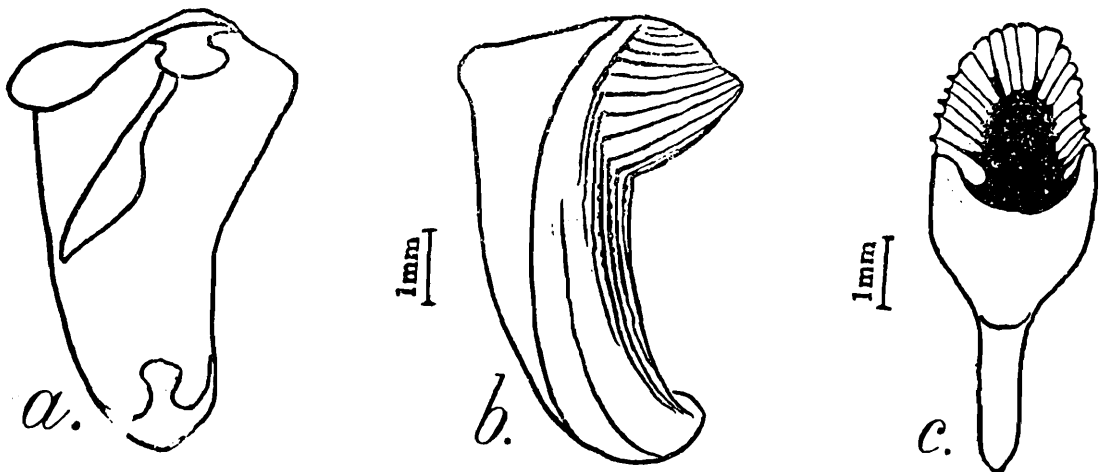


FIGURE 8.—*Teredo (Teredora) clava*, Gmelin.

(a-b) Inner and outer faces of shell respectively, (c) Outer face of pallet.

without interruption from the anterior into the anterior median lobe after making a sharp bent of slightly more than a right angle and proceed downwards (Fig. 8, b). The median area is elongated in the dorso-ventral axis and its anterior part is narrow bearing the denticulated ridges numbering about 10. These are not closely crowded and the periostracum covering it is eroded. The boundary between the anterior and anterior median is not clear. The middle median is a slightly depressed area crossed by a number of concave lines of growth and non-denticulated upturned extensions of the dental ridges. The boundary of the middle median and posterior median is not clear, but the surface of the latter is free from growth lines and ridges, being covered only by a thin light brown periostracum. The posterior median forms a very narrow auricle which appears as a slightly projecting area of the former from its dorsal side.

Viewed from within (Fig. 8, a), the whole of the interior is smooth. The auricle is shaped like a pallet, with the stalk pointing to the umbone and so attached to the posterior median part that as much of the shelf

thus formed projects inward, as there is auricle projecting outward. The apophysis is pendant from the ventral side of the umbo obliquely postero-ventrally. At the extreme ventral edge of the median part, the ventral knob is well developed.

*Pallets*.—Spoon-shaped, broad and thick. The junction of the blade and the stalk is clearly marked. The proximal part of the blade is solid and thick, while the distal part is marked by radiating longitudinal ribs looking somewhat like the leaf of a palm. (Fig. 8,c.)

*Collar*.—A little enlarged.

*Burrow*.—The burrows are lined by a thick-walled calcareous tubing. These tubes are closely crowded and very often twisted together and are not closely adherent to the walls of the burrow.

*Remarks*.—The present form agrees with the figures and descriptions of *Teredo clava* by Gravely (1941) and Roch & Moll (1931).

***Teredo (Teredora) rehderi*, sp. nov. (Fig. 9, a-d).**

*Occurrence*.—Drift logs washed ashore by N. E. monsoon winds on Madras coast during December-January were infested heavily by this shipworm. Seventyfive specimens were collected, the longest one being 4 cms. long. They were recovered from different types of timbers, such as, pieces of Indian red-cedar, planks of mango timber (*Mangifera* sp.), Red pear (*Bursera*), Teak (*Tectona*), drifting bamboo poles, and other as yet undetermined pieces of timber.

*Size*.—Length of Shell—3.5 mm., height of shell—3.5 mm., length of pallet—3.9 mm., length of stalk—1.7 mm., maximum diameter of blade 1.5 mm.

*Shell*.—(Fig. 9, a-b). Short, white with the median part elongated, the anterior area with sinus and callus. The dental ridges pass from the callus area downwards and then backward parallel to the ventral margin. About seventy denticulated ridges are present in the type specimen. At the umbonal and the ventral aspects of the anterior area the dental ridges are closely crowded, but in its middle part, however, they are separated by spaces as wide as themselves. None of the dental ridges are covered by the callus. The anterior median is narrow, about half as wide as the widest part of the posterior median and bearing closely set denticulated ridges which are separated by mere impressed lines and join those of the anterior portion in almost a right angle. The middle median portion is a slightly shallow groove crossed by the non-denticulated curved extensions of the denticulated ridges of the anterior median portion. The posterior median portion is about as wide as the anterior and middle parts combined, and is marked by the extensions of the markings of the middle median. The auricle is very obliquely placed and marked by concentric lines of growth. The rim of the auricle is curved outward creating a concavity on the external surface. The interior is white and smooth except for the auricle which is marked by concentric lines. The auricle overlaps the posterior median area forming a shelf, which is narrow, the major part projecting outward. Pendant from the ventral side of the umbonal knob is the almost cylindrical blade (apophysis), projecting for more than half the length of the shell downward.

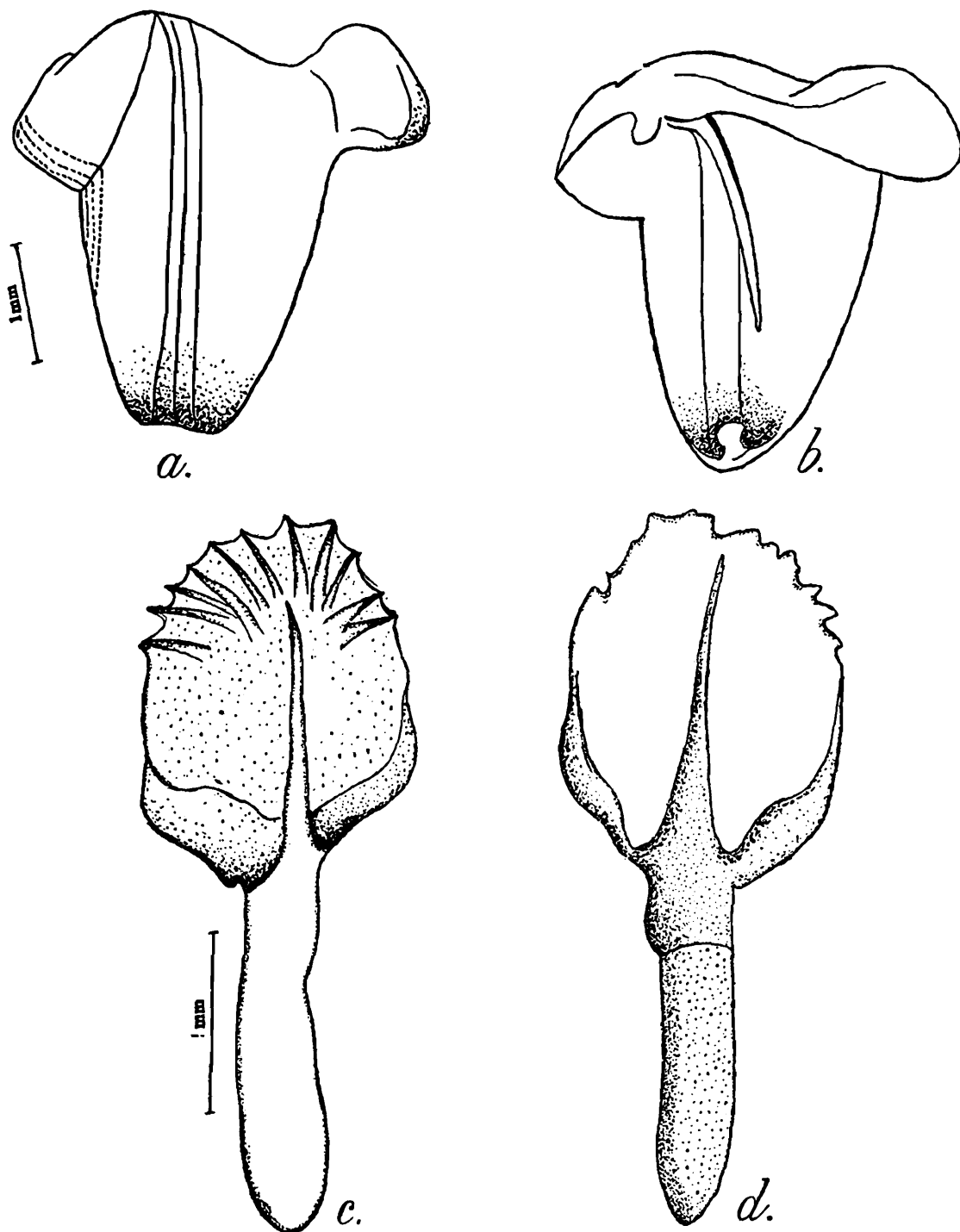


FIGURE 9.—*Teredo (Teredora) rehderi*, sp. nov.

(a-b) Outer and inner faces of shell respectively, (c-d) Outer and inner faces of pallet respectively.

*Pallets*.—(Fig. 9, c-d). Spoon-shaped, with a short, stout, cylindrical stalk. The basal part of the blade is thick, solid and smooth, while the distal portion is nail-like marked by a series of stout, radiating longitudinal ribs.

*Siphons*.—Both inhalant as well as exhalant siphons are of equal-length and diameter, fringed with whorls of tentacles at the rim.

*Burrow*.—Lined with calcareous tubing not firmly adherent to the wood.

NOTE.—Many of the specimens when removed from the wood and kept in a bowl of sea water ejected eggs and sperms which underwent fertilisation and normal cleavage and yielded free swimming larvæ within eighteen hours.

*Remarks.*—In the possession of spoon-shaped pallets, not cupped at terminal border and without periostracum this form undoubtedly belongs to the subgenus *Teredora* Bartsch. In having an obliquely placed auricle on the dorsal margin of the posterior median, the shell resembles *Teredo* (*Teredora*) *vincentensis* Bartsch, *T. (T.) gregoryi* Dall, Bartsch and Rehder, and *T. gazellae* Roch, but can be differentiated from the first, in having more denticulated ridges (about seventy) on the anterior area which are more closely spaced, and in having the posterior median area narrower, being only as wide as the anterior and middle median combined, unlike the Vincent shipworm in which the posterior median is about twice as wide as the anterior and middle median combined. It differs from *T. (T.) gregoryi* in having an apophysis which is almost cylindrical and in the possession of a pallet with a blade which is solid, thick, and smooth at the base, the distal portion of which is nail-like marked by a series of stout radiating longitudinal ribs. The information regarding these features is incomplete for *T. gazellae*. However, a scrutiny of the photograph given by Roch indicates that the shell is higher than it is broad differing from the present form in which the height is almost the same as its width. The present form resembles *Teredo* (*Teredora*) *panamensis* Bartsch in the nature of the pallet, in having the free stalk being short with the basal portion of the blade solid and thick, while the distal portion is nail-like and marked by a series of longitudinally radiating ribs, but differs from it in having the relative proportions of the pallet very different. The present form has a pallet with an overall length of 3.9 mm., of which 2.2 mm. belong to the blade which has a diameter of 1.5 mm., whereas in the Panama shipworm the pallet length is 4.8 mm. of which 3.5 mm. belong to the stalk and the diameter of the blade is 2.3 mm.

The present form is hence treated as a new species *Teredo* (*Teredora*) *rehderi* and can be defined as follows:—

Shell height equivalent to shell length, with posterior median broad about as wide as the anterior and middle median combined, with an obliquely placed auricle, the rim of which is curved outward, with an apophysis which is cylindrical projecting for more than half the length of the shell into its cavity. Pallets spoon-shaped, with stout cylindrical stalk, shorter than the blade, the latter with thick solid basal part and with nail-like depression distally, marked by stout radiating longitudinal ribs.

*Types.*—The holotype will be deposited in the Indian Museum, Calcutta, and the paratypes in the Zoology Research Laboratory, Madras.

(The specific name *rehderi* is given after Dr. Harald A. Rehder of the United States National Museum).

#### Subgenus **Zopoteredo** Bartsch, 1923.

1923. *Zopoteredo*, Bartsch, *Proc. Biol. Soc. Wash.*, Vol. 36, p. 96.

The posterior part (auricle) overlaps the median part on the inside and is completely united with it having no cavity between it, and the median part at the anterior margin of the auricle. The pallet differs from all the other known *Teredos* in having the calcareous portion semi-



disc shaped that is, very short and broad and the corneous portion partly slit and infolded in the median line on the outside so as to practically divide that part into a double cup, but this is not a true double cup, for it does not involve the calcareous portion.

***Teredo (Zopoteredo) bengalensis*, sp. nov.** (Fig. 10, *a-c*).

*Occurrence*.—Four specimens were taken from a drift log (timber undetermined) on 5th January, 1954, from Madras beach. All the specimens were alive and their gonads were ripe and full.

*Size*.—Shell height—3.9 mm., length—3.6 mm., pallet length—5 mm., stalk—2.5 mm.

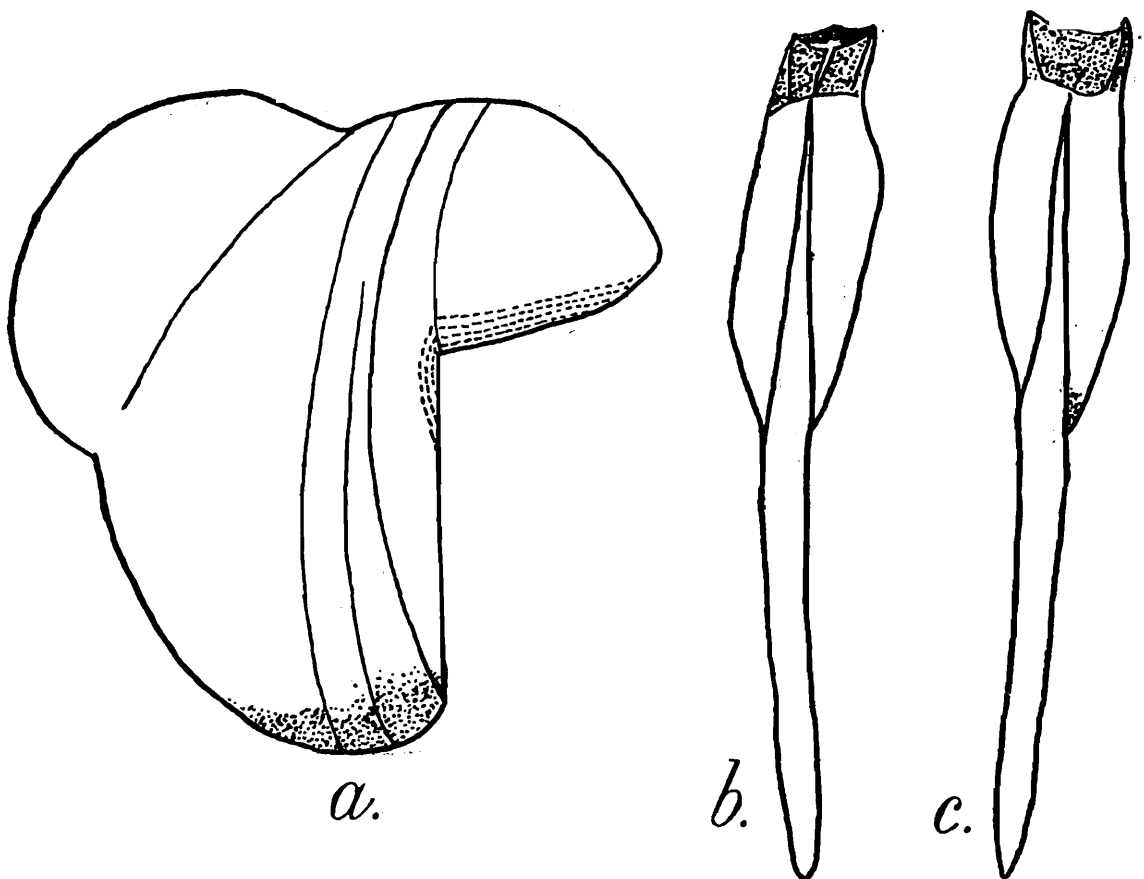


FIGURE 10.—*Teredo (Zopoteredo) bengalensis*, sp. nov.  
(*a*) Shell outer face, (*b-c*) Outer and inner faces of the pallet respectively.

*Shell*.—(Fig. 10-*a*.) Sub-globular, white. The anterior portion with a deep sinus and reflected, smooth, translucent, callus. The dental ridges radiate from this smooth portion backwards over the rest of the anterior area. About 30 ridges could be counted in the specimen figured. These ridges of the anterior portion meet those of the anterior median at almost right angles. The dental ridges of the anterior median portion are closely crowded being separated by mere lines only and bear fine denticles. The middle median is a somewhat depressed groove. Marking the centre of this area are the curved lines of growth, the enfeebled extensions of which extend over the posterior median as well. The posterior median is broad about 1.5 times the width of the anterior and middle median combined, and forms a strong auricle which is marked by clear concentric lines of growth. Internally the umbo forms a strong knob from the inner side of which is pendant, the flat thin blade. The auricle overlaps the posterior median area forming a narrow shelf.

*Pallets*.—(Fig. 10, *b-c*.) With cylindrical translucent stalk, slightly longer than the blade, which uninterruptedly continues to the distal end like the shaft of a feather. At the distal end of the calcareous part of the blade is a horn coloured periostracum which is translucent and is slightly cupped with a long narrow sinus traversing its middle median line on the outside.

*Remarks*.—The subgenus *Zopoterredo* Bartsch includes 3 species namely, *trulliformis*, *fulleri*, and *triangularis*. In the possession of a pallet, the corneous portion of which is partly slit and infolded in the median line on the outside so as to practically divide that part into a double cup, this form belongs to the subgenus *Zopoterredo*. It clearly differs from *trulliformis* Miller, and *triangularis* Edmondson, both in the features of the shell and pallet. However, the present form resembles *Zopoterredo fulleri* Clapp in the possession of a pallet with a slender translucent stalk, which is almost as long as the blade, the latter opaque and milk white and in possessing a narrow horn coloured zone, the distal extremity of which is slightly cupped.

But comparison of the shells and pallets of the present form with those of *fulleri* from Oahu (Hawaii)\* shows the following differences :

In the Madras form :

I. The stalk of the pallet continues uninterruptedly into the blade like the shaft of a quill feather without any demarcation into stalk and blade.

II. The narrow sinus traverses only through the distal horn coloured periostracum on the outside and not into the calcareous part.

III. The sides of the pallet blade are not straight but slope gently towards the posterior end.

IV. The auricle of the present form is prominent unlike that of *fulleri* in which it is described as small by Clapp. Hence the present form is treated as a new species *Teredo (Zopoterredo) bengalensis* and can be defined as follows:—Shell with a well developed auricle with the posterior median part 1.5 times the width of the anterior and middle median put together, and with a pallet having a cylindrical translucent stalk, which uninterruptedly continues to the distal end like the shaft of a quill feather ; and a translucent horn coloured periostracum, with a sinus traversing the middle median line on the outside.

#### ACKNOWLEDGMENTS.

It is with great pleasure that the author takes this opportunity to express his grateful thanks to Dr. C. P. Gnanamuthu, Director, Zoology Laboratory, Madras University, for the guidance and help throughout the course of this work and Dr. C. H. Edmondson of B. P. Bishop Museum, Hawaii, for his helpful suggestions and specimens of ship-worms he sent from Hawaii. To the Syndicate of the Madras University the author is very thankful for the award of a research fellowship during the tenure of which the present work was carried out.

\* I am thankful to Dr. Edmondson for kindly sending me specimens of *T. (Z.) fulleri* from Oahu (Hawaii) for comparison with the Madras form.

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