

中国茎苔虫属的研究*

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茎苔虫属 (*Caulibugula* Verrill, 1900) 隶于唇口目、无囊亚目、双胞科 (Cheilostomata, Anasca, Bicellariellidae)。茎苔虫的群体系由分节的长茎 (stem) 和丛状分枝构成。每节为一空个虫。空个虫的前膜细长, 侧壁有钙质加厚 (Calcareous thickening)。附根一般由茎部始端的空个虫分出。泡状体 (vesicles) 或有或无。分枝双列 (很少单列), 通常呈扇形。大多数种类扇形分枝始端的第一个虫与其后续个虫稍有不同, 常呈倒圆锥形。普通个虫 (ordinary zooids) 系双胞型 (*Bicellariella*-type) 或草苔虫型 (*Bugula*-type)。双胞型个虫呈陀螺形, 前膜短但刺长; 草苔虫型个虫细长形, 前膜长但刺短而少, 或无刺。鸟头体皆有柄, 着生位置因种而异, 吻和颚骨皆呈尖形, 或全无鸟头体。卵胞或有 (口上卵胞 hyperstomial-ovicell) 或无。

茎苔虫属的种可分为两组: 一组种的扇形分枝的普通个虫为双胞型, 如桑给巴尔茎苔虫 *C. zanzibariensis* (Waters); 另一组种为草苔虫型, 如杯茎苔虫 *C. caliculata* (Levinson)。

Busk (1884) 把具有双胞型个虫的种归于双胞苔虫属 (*Bicellaria*, s. l.), 而 Levinsen (1909) 则把具有草苔虫型个虫的种放入草苔虫属。但是由空个虫构成的分节长茎是这类苔虫所特有的稳定特征, 因而具有这一稳定特征的种, 不能归于双胞苔虫属和草苔虫属, 只能归于茎苔虫属 (Harmer, 1926:457)。

茎苔虫属的成员通常栖息在近岸浅海, 有的种从潮间带至水深 100 多米皆有分布, 多数为热带-亚热带种, 主要分布在马来群岛、澳大利亚西部和南部、印度、非洲东岸、中国和日本。此外, 还分布在美洲太平洋沿岸 (加利福尼亚) 和大西洋沿岸 (佛罗里达、卡罗来纳、巴西) 等地。

至今已报道的茎苔虫有以下 16 种:

1. *Caulibugula anulata* (Maplestone, 1879)
2. *C. glabra* (Hincks, 1883)
3. *C. exilis* (MacGillivray, 1890)
4. *C. armata* Verrill, 1900
5. *C. ciliata* (Robertson, 1905)
6. *C. occidentalis* (Robertson, 1905)

* 中国科学院海洋研究所调查研究报告第 1017 号。
文稿承刘瑞玉教授、郑守仪副教授审阅, 深致谢意。
收稿日期: 1979 年 2 月 9 日。

7. *C. californica* (Robertson, 1905)
8. *C. dendrograpta* (Waters, 1913)
9. *C. zanzibariensis* (Waters, 1913)
10. *C. mortenseni* Marcus, 1925
11. *C. separata* Harmer, 1926
12. *C. inermis* Harmer, 1926
13. *C. tuberosa* Hastings, 1939
14. *C. bocki* Silén, 1941
15. *C. aspinosa* Mawatari, 1956
16. *C. pearsei* Maturo, 1966

本文系作者对中国科学院海洋研究所历年来搜集的标本进行系统整理后写成, 共报道 10 种, 其中 3 种为中国首次记录, 6 种为新种。新种模式标本保存在中国科学院海洋研究所(青岛)。

种的检索

1. 分枝始端和茎末端之间只有一个空个虫..... 2
分枝始端和茎末端之间有两个空个虫..... 7
2. 分枝始端第一个虫呈陀螺形, 一般多刺, 其他个虫也有类似的刺..... 3
分枝始端第一个虫不呈陀螺形, 无刺或刺少, 其他个虫也无刺或刺少..... 4
3. 有泡状体(单生或聚生)..... 桑给巴尔茎苔虫 *C. zanzibariensis*
无泡状体..... 笔石茎苔虫 *C. dendrograpta*
4. 有泡状体..... 5
无泡状体..... 6
5. 空个虫长短大致相等, 分枝呈杯状; 个虫由始端向末端逐渐增宽; 分枝始端的个虫端刺为 3—1, 末端个虫为 1—1, 内刺长于外刺, 约为个虫长度的两倍; 鸟头体细长形, 鸟头不凸, 吻钩状..... 杯茎苔虫 *C. caliculata*
空个虫有长短两型; 分枝扇丛状; 个虫细长形, 两侧向前表面翻卷; 端刺为 2—1, 皆短; 鸟头体小形, 但鸟头较凸, 吻钩不明显..... 无规茎苔虫(新种) *C. irregularis* sp. nov.
6. 茎和分枝均粗壮, 无刺, 无鸟头体..... 裸茎苔虫 *C. inermis*
茎和分枝皆纤细, 有刺, 有小型鸟头体..... 纤细茎苔虫(新种) *C. gracilentia* sp. nov.
7. 鸟头体大, 长度约为个虫长的 1/2; 分枝始端两个个虫棒锤形; 泡状体小, 椭圆形, 细柄常扭曲..... 长吻茎苔虫(新种) *C. longirostrata* sp. nov.
鸟头体或有或无; 泡状体或有或无, 如有则较大, 柄直立..... 8
8. 分枝始端两个(或两个以上)个虫呈长锥形; 空个虫横切面呈圆形; 分枝个虫面向分枝中轴, 前膜仅占前区 1/4—1/3; 无刺, 无鸟头体, 无卵胞, 无泡状体..... 长锥茎苔虫(新种) *C. longiconica* sp. nov.
分枝始端两个个虫呈倒陀螺形; 空个虫横切面为四方形; 分枝个虫背向分枝中轴; 前膜占前区 1/2 以上; 有鸟头体, 有卵胞..... 9
9. 分枝始端两个个虫接续排列; 泡状体大, 呈梨形, 与细柄对应端光滑无刺..... 中华茎苔虫(新种) *C. sinica* sp. nov.
分枝始端两个个虫并列; 泡状体卵圆形, 与细柄对应端有刺状突起..... 孪生茎苔虫(新种) *C. binata* sp. nov.

1. 笔石茎苔虫 *Caulibugula dendrograpta* (Waters, 1913) (图 1:2)

Stirparia dendrograpta Waters, 1913: 470, pl. 66, figs. 4—9.

Caulibugula dendrograpta, Harmer, 1926: 459, pl. 33, figs. 1—4; Hastings, 1932: 408, text-fig. 4a; Maturo, 1966: 574, text-fig. 14.

我们的标本系由 3 个空个虫和扇状分枝始端的第一个虫构成。空个虫长圆柱形, 两

侧钙质加厚较强,室腔(lumen)中部细狭,末端较膨大。在末端一空个虫的侧面分出一侧枝,侧枝仅有一个空个虫,其长度约为主茎空个虫的三分之一,它以一个长在主茎上的环状体(annulation)与主茎相连接。此空个虫钙化弱,其后续个虫为分枝始端的第一个虫。第一个虫呈陀螺形,前膜始端有一长裂,周缘有11根粗刺。在第一个虫背面分出两个子个虫。由于分枝断折,我们未见这两子个虫的末端部分及其后续的子个虫。尽管我们的标本不完整,但与 Waters (1913) 的原始描述和图以及 Harmer (1926) 的描述和图对照,空个虫及分枝始端第一个虫的特征相符,故确认我们的标本属于 Waters (1913) 的种,但仍需补充说明分枝部分的特征。

标本采集地 南海(广东东部近岸), $22^{\circ}45'N$, $115^{\circ}15'E$, 水深70米,与拟眼尼苔虫 *Nellia oculata* Busk 丛生在一起。

地理分布 桑给巴尔岛、松巴哇岛东部、望加锡海峡、新几内亚北端、马来亚, Maturo(1966)报道本种也分布在卢克奥特角(北卡罗来纳);为暖水种。在中国系首次记录。

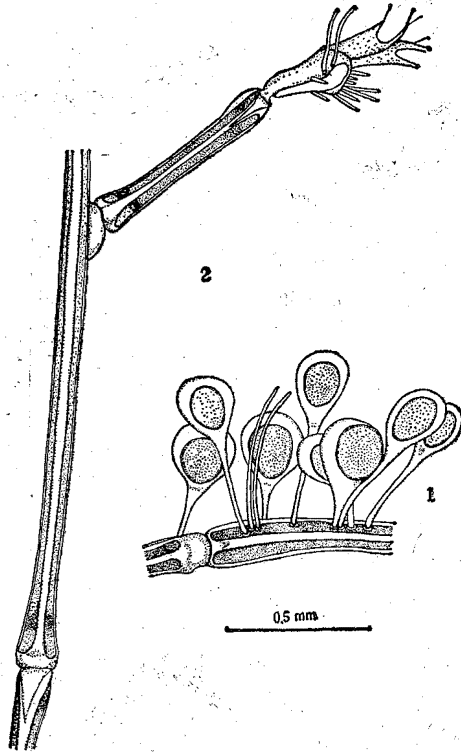


图 1 莫顿茎苔虫 *Caulibugula mortenseni* 和笔石茎苔虫 *Caulibugula dendrograptia*
1. 莫顿茎苔虫的空个虫和泡状体; 2. 笔石茎苔虫的前面观, 示个虫和第一个虫

2. 桑给巴尔茎苔虫 *Caulibugula zanzibariensis* (Waters, 1913) (图 2, 3)

Stirparia zanzibariensis Waters, 1913: 469, pl. 66, figs. 1—2, pl. 69, fig. 14.

Caulibugula zanzibariensis Harmer, 1926: 410, pl. 33, figs. 5—10.

群体由分节的长茎和扇丛状分枝构成。空个虫比笔石茎苔虫的粗壮, 侧壁钙质加厚较强壮。大部分空个虫都有膜质的泡状体。泡状体呈梨形, 有短柄, 单生或聚生。附根

由空个虫分出,在泡状体间也可有少数微细的附根。

每一扇丛状分枝始端的第一个虫前膜短,有时前膜始端有裂状延长,前膜周缘有10—11根长刺。在第一个虫顶端长出两个呈背向排列的子个虫,因此两子分枝也呈背向排列,面向外侧。这两个子个虫的端刺通常为2—1,有时为1—1,有时无内刺。愈向分枝

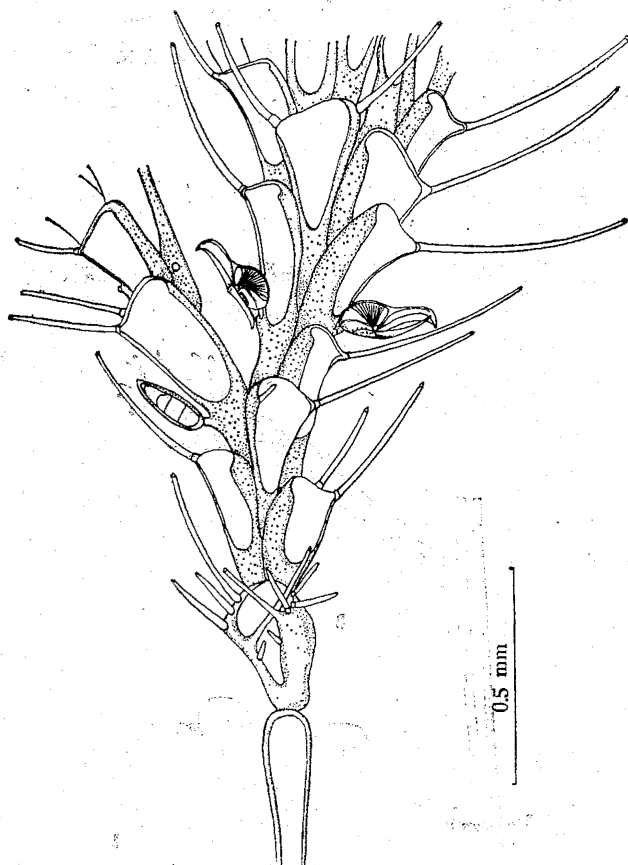


图2 桑给巴尔茎苔虫 *Caulibugula znazibariensis*
前面观,示第一个虫,普通个虫、端刺、鸟头体

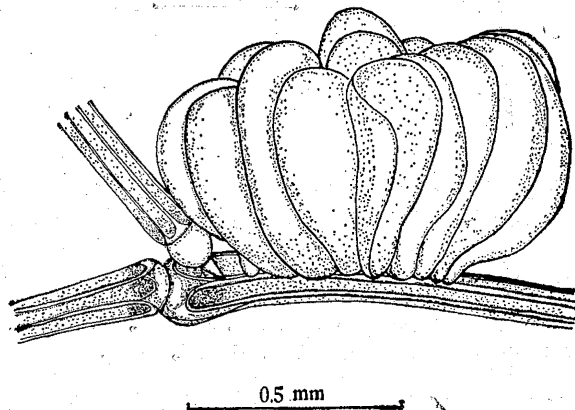


图3 桑给巴尔茎苔虫,示空个虫和泡状体

末端个虫端刺愈少,分枝末端常无刺。一般仅外刺发育,内刺常消失。所有的刺基部均有关节。鸟头体位于前膜底部裸壁外侧,细长形,附在一个疣突上。我们的标本大部分鸟头体都已脱落。未发现卵胞。

标本采集地 南海(海南岛东部近岸), $19^{\circ}30'N$, $110^{\circ}15'E$, 水深 97 米,与拟眼尼苔虫丛生在一起,若干群体。

地理分布 澳大利亚西部、桑给巴尔岛、爪哇岛、松巴哇岛、新几内亚、苏拉威西岛南部;为热带种。在中国系首次记录。

3. 中华茎苔虫(新种) *Caulibugula sinica* sp. nov. (图 4, 5, 6, 7)

正模标本 标本号: 60 BBS003, 1960 年 2 月 10 日采于南海(海南岛东部近岸), $19^{\circ}30'N$, $110^{\circ}15'E$, 水深 97 米,底质为砂质泥,一个完整群体,与拟眼尼苔虫丛生在一起。

这一新种最特殊的一个特征是与扇丛状分枝始端第一个虫相接的不是空个虫;而是

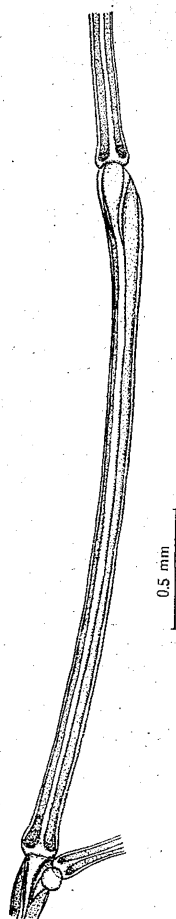


图 4 中华茎苔虫(新种)
Caulibugula sinica
sp. nov. 的空个虫

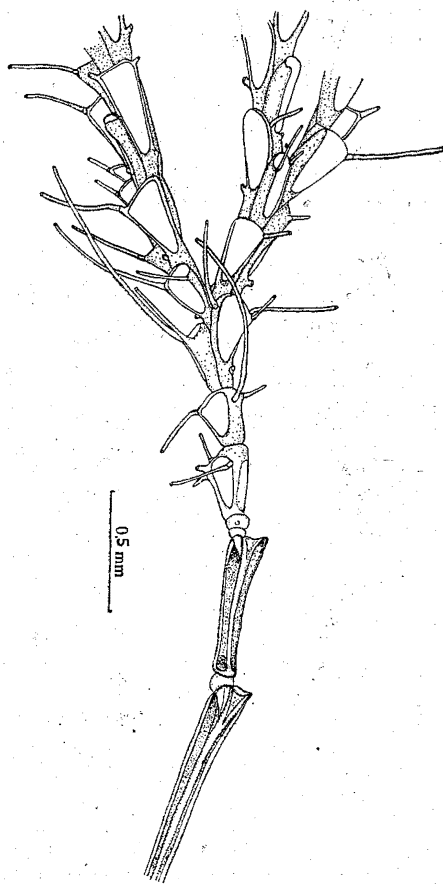


图 5 中华茎苔虫(新种)前面观,示茎末端的一个空个虫、扇丛状分枝始端两个连续排列的个虫、普通个虫和端刺

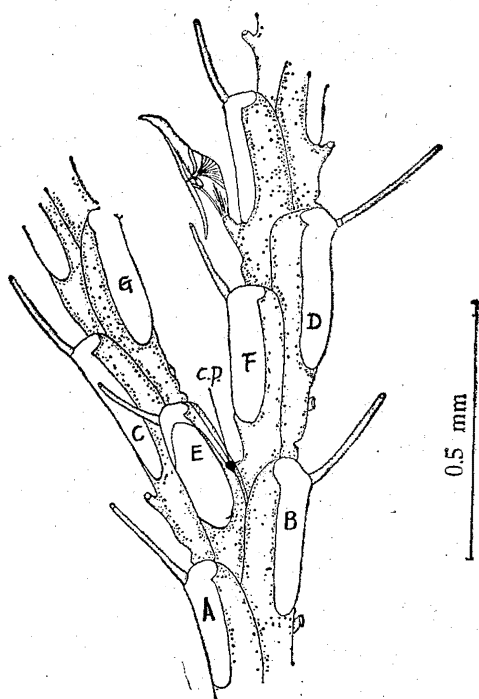


图6 中华茎苔虫(新种)分枝末端
示个虫、端刺、鸟头体和分岐方式

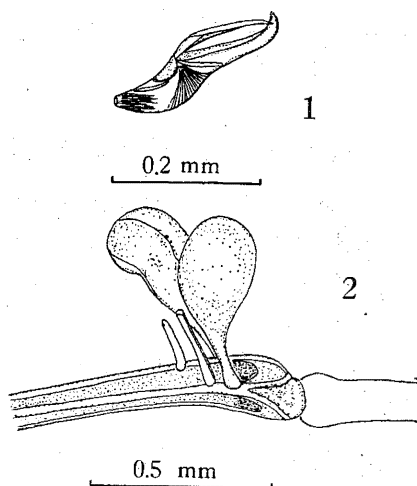


图7 中华茎苔虫(新种)
1. 鸟头体; 2. 空个虫和泡状体

与其相似的个虫,呈初虫状。它有很短的前膜,其末端左侧有3根基部有关节的长刺,右侧的一根长刺基部也有关节;这些刺均指向外侧或分枝末端。这一初虫状的个虫与茎末端细短的空个虫之间有一个环状体。它的后续个虫为分枝始端第一个虫;第一个虫与其后续的分枝个虫基本同形,但短而宽,前膜短,其末端左侧一根长刺斜向始端,右侧有两根刺,其中内缘一根刺很长,大体上与分枝中轴平行,斜向分枝末端,外缘一根刺较短,指向左侧,两刺几成直角。第一个虫在其背面顶端分出两个背向排列的子个虫参与分枝的分歧。始位的子个虫端刺为1—1,末位的子个虫端刺为2—1,其余的分枝个虫端刺都为1—1,但内刺有逐渐消失的倾向。分歧方式属于 Harmer 的第4型。由于个虫背向排列,因此分歧后产生的子分枝不在同一平面上,也呈背向排列。一般分枝个虫细长形,末端宽,始端狭,顶边圆形或平截,内缘内卷而游离。前膜细长形,由始端向末端增宽,约占个虫前区的三分之一。鸟头体细长形,着生在前膜始端裸壁外侧的一个粗而短的疣突上。鸟头不凸,吻狭长,吻钩不明显,颚骨长三角形。现有标本的鸟头体大多已脱落,但疣突清晰可见。未发现卵胞。

构成长茎的空个虫细长,两端稍膨大,横切面为四方形。茎常分枝。微细的附根由茎基部的空个虫分出,有些附根膨大成为泡状体。泡状体有长柄,呈梨形。

新种和桑给巴尔茎苔虫相似,两者的区别是:(1)新种分枝始端和长茎末端之间有两个接续排列的个虫,其中一个为第一个虫,另一个呈初虫状,与茎末端空个虫相接;后者分枝始端与长茎末端之间只有一个个虫,即第一个虫,和第一个虫相接的是长茎末端一个空

个虫；(2)新种第一个虫刺少，3根；后者第一个虫刺多，9—11根；(3)新种泡状体单生，柄细长，后者泡状体单生或聚生，但通常聚生，柄很短；(4)新种端刺细弱，后者端刺粗壮；(5)新种鸟头体的吻比后者细弱，吻端不呈钩状，鸟头不凸，后者吻端呈钩状，鸟头明显凸出。

4. 孪生茎苔虫(新种) *Caulibugula binata* sp. nov. (图 8, 9, 10, 11, 12)

正模标本 标本号：75BBE002, 1975 年 7 月 21 日采于东海, $31^{\circ}30'N$, $126^{\circ}00'E$, 底质为软泥, 水深 75 米, 与裸茎苔虫 *Caulibugula inermis* Harmer, 1926 生活在一起。一个完整的群体。

其他标本 从东海另外两站 ($31^{\circ}30'N$, $126^{\circ}30'E$; $30^{\circ}30'N$, $126^{\circ}30'E$) 取得两号标本, 仅获得其空个虫(有泡状体), 分枝部分都已丧失, 也与裸茎苔虫生活在一起。

分枝始端和长茎末端之间的两个个虫并列成一个“双生体”(twin), 因而新种定名为“孪生”茎苔虫。这两个孪生个虫有宽阔的前膜, 光裸无刺, 它们的始端借一黄色几丁质关节与长茎最末端的一个空个虫相连接; 在其末端背面各自分出两个面向外侧的子个虫参

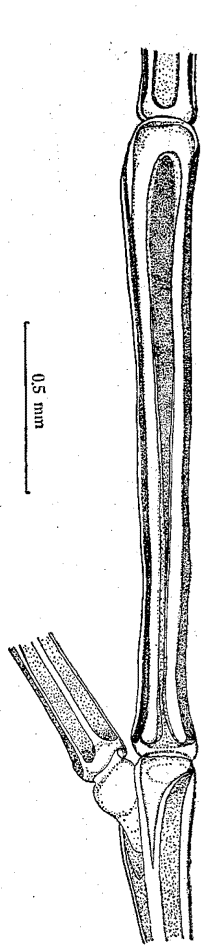


图 8 孪生茎苔虫(新种)
Caulibugula binata
sp. nov., 示茎的空个虫

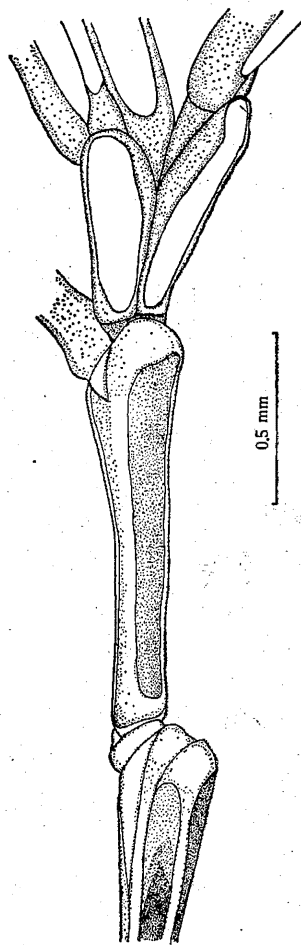


图 9 孪生茎苔虫(新种),
示茎的末端空个虫和扇状
分枝始端一对双生个虫

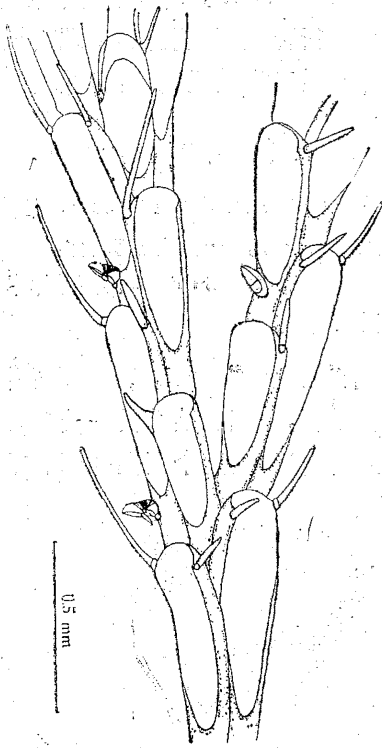


图 10 孪生茎苔虫(新种),分枝末端前面观,示个虫、端刺、鸟头体

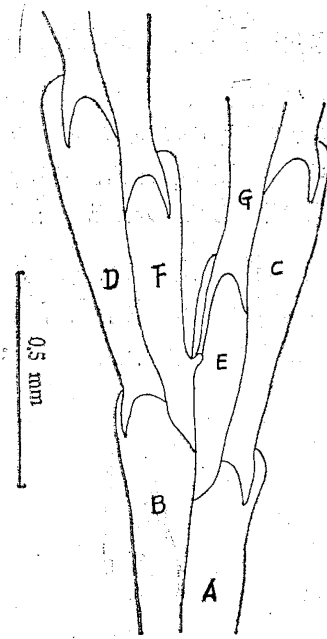


图 11 孪生茎苔虫(新种),背面观,示分歧方式

与分枝的分歧,分歧方式为 Harmer 的第 4 型。与这两个并列个虫接续的两支扇状分枝恰好对称地背向排列在群体中轴的两侧。

构成长茎的空个虫两端稍膨大。一般,茎之末端部分的空个虫较粗短,近始端的空个虫较细长,但横切面皆呈四方形。茎之末端常有分枝,始端部分的空个虫分布有细密的附根,在细密杂乱的附根中,夹生有卵圆形的泡状体。泡状体的柄细而长,柄之对应端有刺状突起。

群体的扇丛状分枝部分较高大,约占整个群体的三分之一。个虫细长,顶边圆形,两侧向分枝前表面翻卷而游离,末端较宽,始端较狭。前膜宽阔,末端较宽、始端较狭,占个虫前区三分之二以上。端刺粗长,1—1,基部均有关节,一般分枝外列个虫刺较发达,分枝末端刺有逐渐消失的倾向。鸟头体很小,着生在个虫始端裸壁外侧一个小疣突上。鸟头不凸,吻短,吻钩不明显,吻之上半部几乎平直,颚骨为简单三角形。触手约 12 根。未发现卵胞。

新种在个虫形状、鸟头体的尺寸及着生位置等方面与加州茎苔虫 *Caulibugula californica* (Robertson, 1905) 有些相似。但后者一般刺较多,群体借一膜质的附着基盘 (attachment-disc) 固着在基质上,鸟头体的鸟头很凸,无泡状体,分枝始端第一个虫为空个虫,细棒形,整个群体比较纤细;新种的端刺少,群体借附根附着在基质上,鸟头体的鸟头不凸,有泡状体,分枝始端第一个虫不是空个虫,陀螺形,整个群体比较粗壮。本新种在群体粗

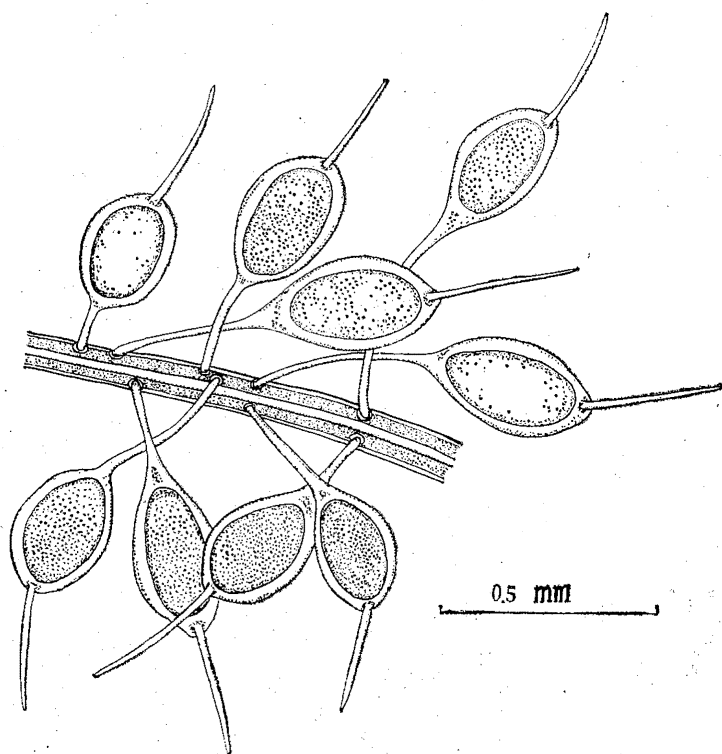


图 12 孪生茎苔虫(新种), 示泡状体

壮程度、个虫形态以及端刺的发达程度等方面更接近中华茎苔虫(新种);但两者分枝始端两个个虫形状和排列方式显著不同;此外,本新种鸟头体小,吻短,泡状体在柄的对应端有很长的刺状突起,而中华茎苔虫(新种)的鸟头体较大,吻细长,泡状体为简单梨形,无刺状突起。

5. 长吻茎苔虫(新种) *Caulibugula longirostrata* sp. nov. (图 13, 14, 15, 16)

正模标本 标本号: 60BBE 004, 1960 年 3 月 11 日采于南海(海南岛榆林南部浅海), $17^{\circ}00'N$, $109^{\circ}30'E$, 底质为软泥,水深 164 米,与拟眼尼苔虫丛生在一起。一个完整的群体。

新种鸟头体特别细长,约为个虫长度的二分之一,这是由于鸟头体的吻特别长的缘故,故定名为“长吻”茎苔虫。

群体由纤细的扇丛状分枝和分节的长茎构成。构成长茎的空个虫细而长,横切面为四方形,始端不膨大,但末端很膨大。茎之基部的空个虫分出稀少的附根,其中个别附根膨大为椭圆形的泡状体。泡状体的柄细长,常弯曲。

扇状分枝始端的第一个虫是一空个虫,其长度约为前位空个虫的三分之一,末端膨大,向始端逐渐变细。在其前表面有一顶端宽阔、两侧向始端逐渐变狭的开阔区,开阔区的始端几乎伸至该个虫的底部。此开阔区的两侧具有基部有关节的细刺,左侧 3 根,右侧 1 根,皆斜向分枝末端。在第一个虫的末端背面分出两个子个虫,其中始位的子个虫不参与分枝的分歧,末位子个虫的始端裸壁很长,其长度大于始位个虫。末位子个虫和始位子

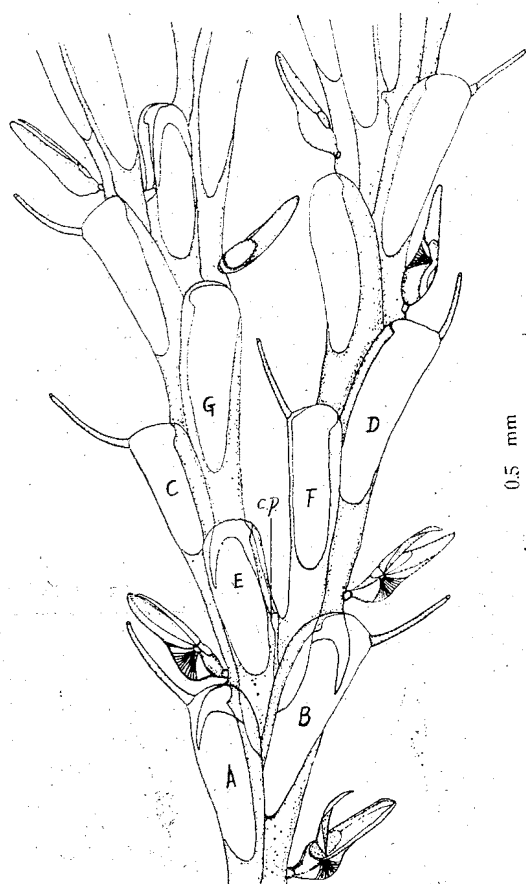


图 13 长吻茎苔虫(新种) *Caulibugula longirostrata* sp. nov.

前面观,示个虫、端刺、鸟头体和分枝方式

个虫的直接后续个虫参与分枝的分歧;这两个个虫呈背向排列,因而使分歧后的两子分枝也呈背向排列。分歧方式属于 Harmer 的第 4 型。

分枝个虫细长形,始端稍狭,顶边钝圆,两侧稍向分枝前表面翻卷。前膜细长,几乎伸达个虫始端。仅有 1 根外刺,无内刺,刺的基部均有关节。刺细长,往往外列分枝的刺发达,内列分枝的刺仅显痕迹或消失。几乎每一个虫在其始端裸壁的外侧都有一个长吻鸟头体,固着在一个小疣突上,其长度约为个虫长的二分之一,通常指向分枝末端。吻细长,末端稍弯曲但不呈钩状,上半部几乎平直,仅在吻端略向下弯,鸟头稍凸,颞骨为简单三角形。未发现

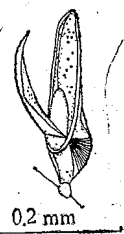


图 14 长吻茎苔虫
(新种)之鸟头体

卵胞。

新种在外观上与桑给巴尔茎苔虫相似,但后者端刺长而多,鸟头体吻较短,分枝始端第一个虫呈陀螺形,刺很多,泡状体梨形,单生或(通常)聚生;新种的端刺少,仅有 1 根外

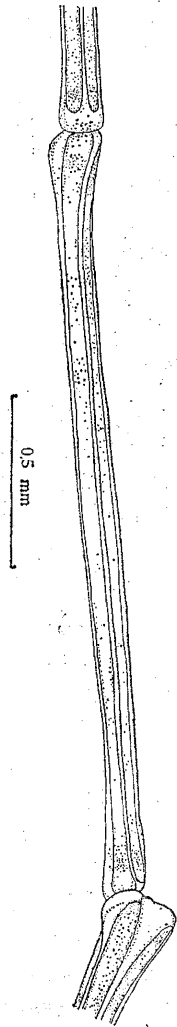


图 15 长吻茎苔虫
(新种)之空个虫

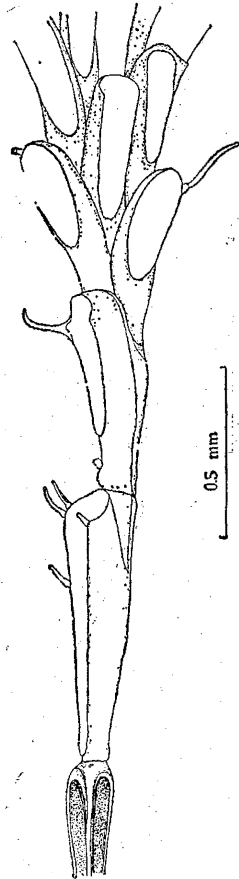


图 16 长吻茎苔虫(新种)
前面观,示第一个虫和普通个虫

刺,鸟头体吻极长,分枝始端第一个虫呈棒形,刺很少,泡状体单生,椭圆形。它与中华茎苔虫(新种)的区别在于后者端刺强壮、鸟头体短小、群体比较粗壮、第一个虫呈陀螺形。

6. 长锥茎苔虫(新种) *Caulibugula longiconica* sp. nov. (图 17, 18, 19, 20)

正模标本 标本号: 59BBE 004, 1959 年 2 月 1 日采于东海南部, $28^{\circ}30'N$, $124^{\circ}00'E$, 底质为碎贝壳, 水深 86 米, 与美髯松苔虫 *Caberea lata* Busk 丛生在一起。一个完整的群体。

副模标本 标本号: 59BBE005, 1959 年 2 月 4 日采于东海, $30^{\circ}00'N$, $123^{\circ}30'E$, 底质为褐色泥质砂, 水深 61 米, 与美髯松苔虫丛生在一起, 一个完整的群体; 59BBE006, 1959 年 10 月 22 日采于东海, $29^{\circ}00'N$, $124^{\circ}00'E$, 底质为泥质砂, 水深 81 米, 与拟眼尼苔虫丛生在一起。一个群体。

群体系由分枝部分和长茎构成。茎由许多长度大致相等的空个虫构成。空个虫圆柱

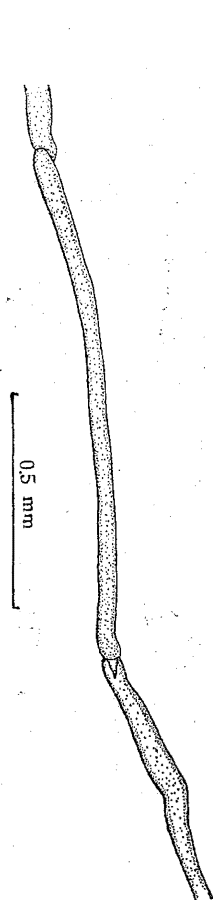


图 17 长锥茎苔虫(新种)
Caulibugula longiconica
sp. nov., 示空个虫

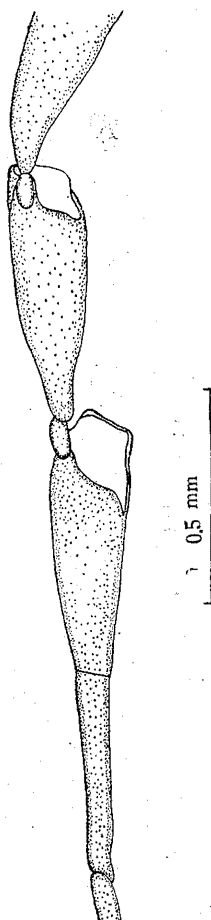


图 18 长锥茎苔虫(新种),
前侧面观, 示茎末端一
空个虫及其后续个虫

形,直或稍扭曲。附根由茎之基部的空个虫分出,粗细不匀。茎末端一个空个虫从其中部开始向末端逐渐膨大成长锥形,其末端前表面有一心脏形开阔区(始端尖形),在其末端背面借一根状突起与分枝始端第一个虫相连接。第一个虫为空个虫,形状与其前位空个虫相似,但较短,其末端前表面也有一心脏形开阔区(始端圆形)。在第一个虫末端背面分出两个参与分枝分歧的子个虫(副模标本),有的群体(正模标本)在茎末端空个虫和分枝始端第一个虫之间还有一个或两个在形状上与第一个虫类似的空个虫(正模标本),也就是说从茎末端空个虫数起至第四或第五个个虫才参与分枝的分歧。分歧方式属 Harmer 第 4 型。

分枝由双列个虫构成,两列交互排列的个虫都面向分枝中轴。个虫长锥形,末端稍宽,始端细狭,外缘稍内凹,内缘则以同一方向外凸。前膜很小,仅占个虫前区的四分之一左右,因此裸壁极其发达。无刺,无鸟头体,无卵胞。未发现泡状体。

新种的个虫形状在茎苔虫属中是很特殊的。个虫前膜短小,都面向上,具有双胞胎个

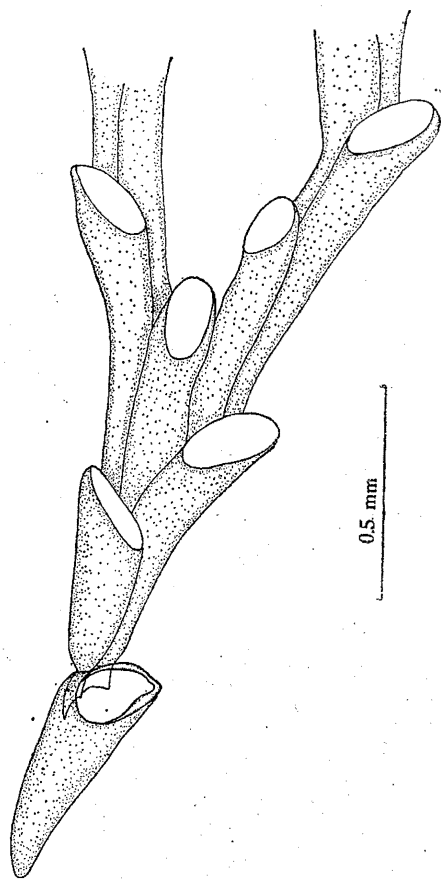


图 19 长锥茎苔虫(新种), 前面观,
示第一个虫和普通个虫

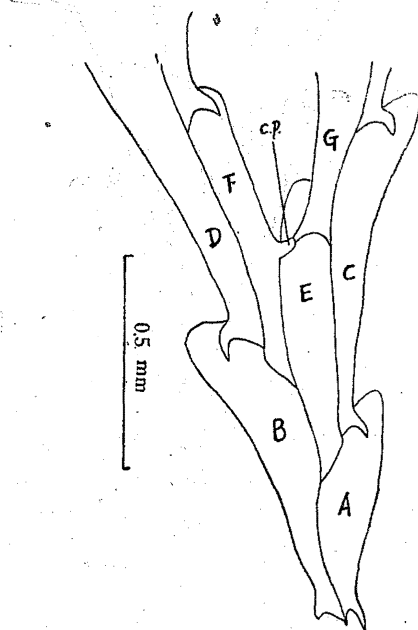


图 20 长锥茎苔虫(新种),
背面观, 示分歧方式

虫的特点, 但个虫细长而又无刺, 又具有草苔虫型个虫的特点。因此它是介于双胞胎型和草苔虫型种之间的中间类型。

7. 无规茎苔虫(新种) *Caulibugula irregularis* sp. nov. (图 21, 22, 23, 24)

正模标本 标本号: 59BBS003, 1959 年 7 月 13 日采自南海(海南岛东部近海), $19^{\circ}15'N$, $111^{\circ}00'E$, 底质为泥质砂, 水深 79 米, 与拟眼尼苔虫生活在一起, 一个群体。

群体系由扇丛状分枝和分节的长茎构成。茎由粗细相同但长短不等的空个虫构成, 短空个虫约为长空个虫的三分之二。光滑茎苔虫 *Caulibugula glabra* (Hincks) 的长短两种空个虫是有规则地接续排列的, 但新种的长短两种空个虫的接续是不规则的, 连续两个或三个长空个虫有时后续一个短空个虫, 有时则后续两个或三个短空个虫, 因而定名为“无规”茎苔虫。空个虫的形状与杯茎苔虫 *Caulibugula caliculata* (Levinson) 相似, 两端略膨大, 横切面为四方形。茎的末端常有分枝。附根由茎部的空个虫分出, 较粗但稀少, 有的附根膨大为梨形泡状体, 泡状体的末端(与柄对应的一端)几呈截形。

扇丛状分枝始端的第一个虫为空个虫, 其长度约为长空个虫的二分之一, 末端稍膨

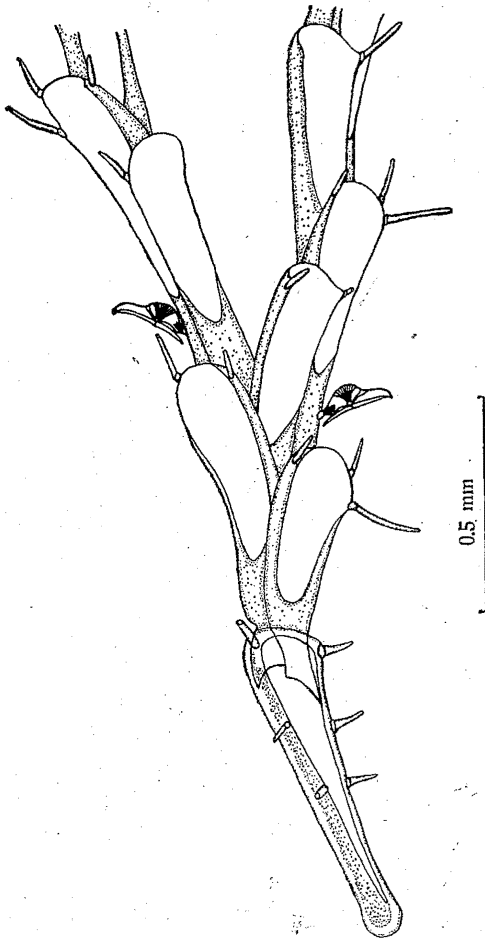


图 21 无规茎苔虫(新种) *Caulibugula irregularis* sp. nov. 前面观, 示第一个虫、普通个虫、端刺、鸟头体

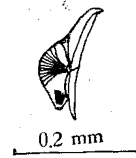


图 22 无规茎苔虫(新种)之一鸟头体

大, 前表面有一末端钝圆、始端呈裂状的长三角形未钙化区, 该区两侧各有短刺 3 根, 指向侧面。第一个虫后续的两个子个虫形状与其余的分枝个虫相似, 但稍粗宽, 始位子个虫端刺为 2—1, 末位子个虫为 1—1。分歧方式属于 Harmer 的第 4 型。普通分枝个虫细长形, 末端和中部稍宽, 始端较狭, 顶边圆形, 两侧稍向前表面翻卷。前膜宽阔, 末端最宽, 始端最狭, 占个虫前区的三分之二以上。端刺 2—1 或 1—1; 在 2—1 的情况下, 其中一根外刺恰好位于外顶角, 另一根外刺位于个虫末端偏下位的侧壁上。所有的刺基部均有关节。通常分枝外列个虫的刺发达, 内列个虫的刺较细弱或消失, 分枝末端无刺。鸟头体小, 但鸟头稍凸, 吻细长, 吻钩不明显, 颞骨呈三角形, 着生在个虫始端裸壁侧面一个小疣突上。现有标本鸟头体多半已脱落。未发现卵胞。

新种的个虫形状与加州茎苔虫 *Caulibugula californica* (Robertson, 1905) 很相似。但后者通常茎部始端的空个虫较长, 末端的较短, 个虫外顶角成锐角, 鸟头体的鸟头很凸, 吻很短, 吻钩明显, 有卵胞, 群体借一膜质的附着基盘固着在基质上; 新种的长短两种空个虫

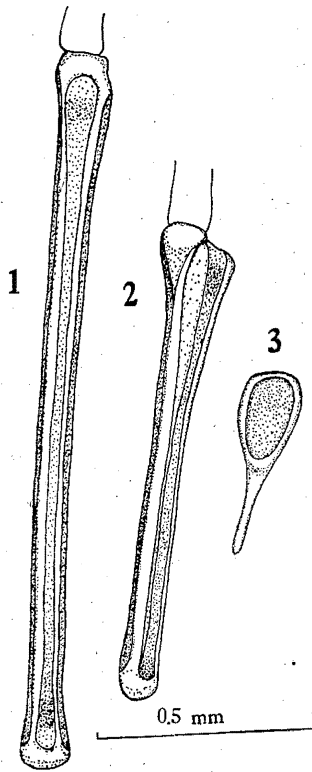


图 23 无规茎苔虫(新种)

1. 一个长空个虫； 2. 一个短
空个虫； 3. 一个泡状体

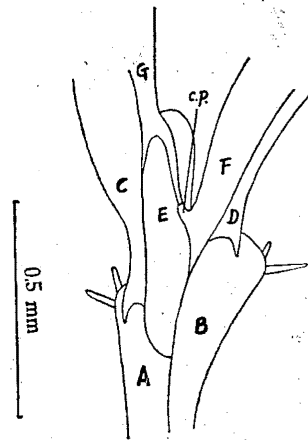


图 24 无规茎苔虫(新种)

背面观, 示分歧方式

不规则接续, 个虫外顶角圆形, 鸟头体的鸟头稍凸, 吻细长, 吻钩不明显, 无卵胞, 群体以附根附着在基质上。

8. 纤细茎苔虫(新种) *Caulibugula gracilentia* sp. nov. (图 25, 26)

正模标本 标本号: 59BBS004, 1959年11月18日采于南海(海南岛西南部近海), $18^{\circ}15'N$, $108^{\circ}45'E$, 底质为中砂、石砾, 水深45米, 与拟眼尼苔虫生活在一起, 一个群体。

副模标本 标本号: 59BBS005, 1959年11月9日采于南海(海南岛西南部近海), $18^{\circ}15'N$, $108^{\circ}00'E$, 底质为中砂, 水深86米, 与美髯松苔虫生活在一起, 一个群体。

群体纤细。茎由长度大致相等的空个虫构成。空个虫细长, 在已知种类中系最细弱者, 两端稍膨大, 横切面为四方形, 四棱钙化极弱。附根由茎基部的空个虫分出, 较粗, 其宽度约为空个虫的 $1/3-1/2$ 。未见泡状体。

扇状分枝始端的第一个虫为空个虫, 其长度约为前位空个虫的三分之一, 其前表面有一末端较宽、向始端逐渐变狭的未钙化区, 两侧各有三根对称排列的侧刺, 斜向分枝末端, 基部均有关节。第一个虫在其末端背面分出两个背向排列的子个虫, 形状与其后续的分枝个虫相似, 端刺为1—1, 外刺细长, 内刺细短。分歧方式属于 Harmer 的第4型。分枝

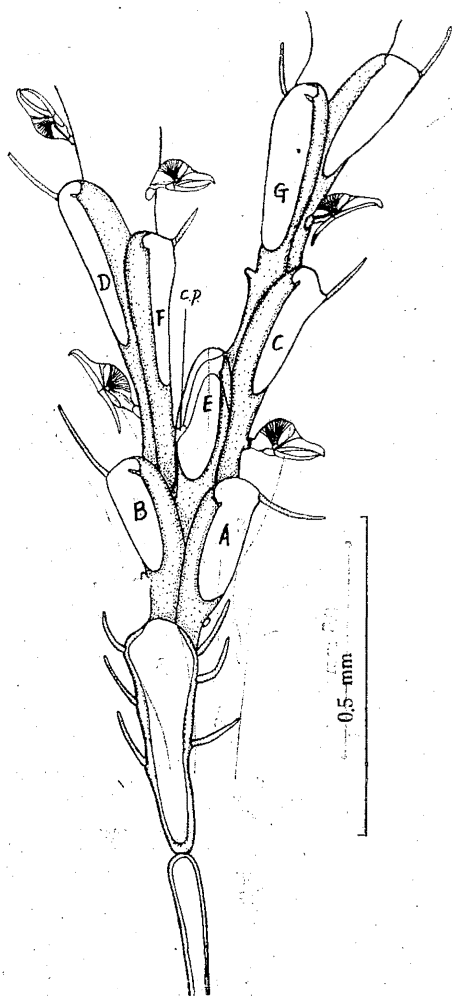


图 25 纤细茎苔虫(新种) *Caulibugula gracilentia* sp. nov.
前面观,示第一个虫、普通个虫、端刺、鸟头体和分枝方式

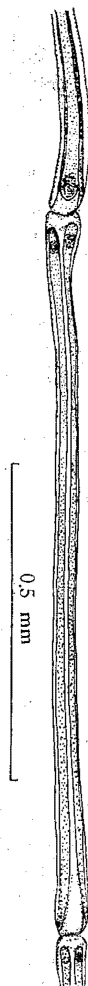


图 26 纤细茎苔虫
(新种)之空个虫

个虫细长形,末端宽,向始端逐渐变狭,顶边圆形,内缘向前表面翻卷而游离,外缘稍向末端倾斜。端刺为1—1,基部均有关节,外刺细长,内刺细短,往往仅显痕迹(甚至无内刺)。前膜宽阔,末端比始端稍宽,约占个虫前区的二分之一。始端裸壁比较发达。鸟头体小形,着生于始端裸壁外侧的一个小疣突上。鸟头较凸,吻细长,吻钩不明显,颚骨为简单三角形。未发现卵胞。

新种最显著的特征是群体极纤细。这是由于构成长茎的空个虫和分枝个虫都极其细弱。它在形态上与莫顿茎苔虫 *Caulibugula mortenseni* Marcus 有些相似,但后者个虫无端刺,有梨形泡状体,有卵胞,鸟头体吻较短;新种有端刺,无泡状体,无卵胞,鸟头体吻细长。两者的第一个虫也显著不同,新种的第一个虫有对称排列的三对侧刺,但莫顿茎苔虫的第一个虫为简单的空个虫,无侧刺。

9. 杯茎苔虫 *Caulibugula caliculata* (Levinsen, 1909) (图 27)

Bugula caliculata Levinsen, 1909: 101. pl. 3, figs. 1a—1g.

群体系由杯状分枝部分和反复分枝的茎部构成。群体的茎部是由许多两端稍宽、横切面为四方形的细长空个虫构成。茎通常分枝,分出的侧枝往往又再分出细枝,这些分枝常有交错。每一茎分枝的顶端都接续一个杯状的分枝部分。

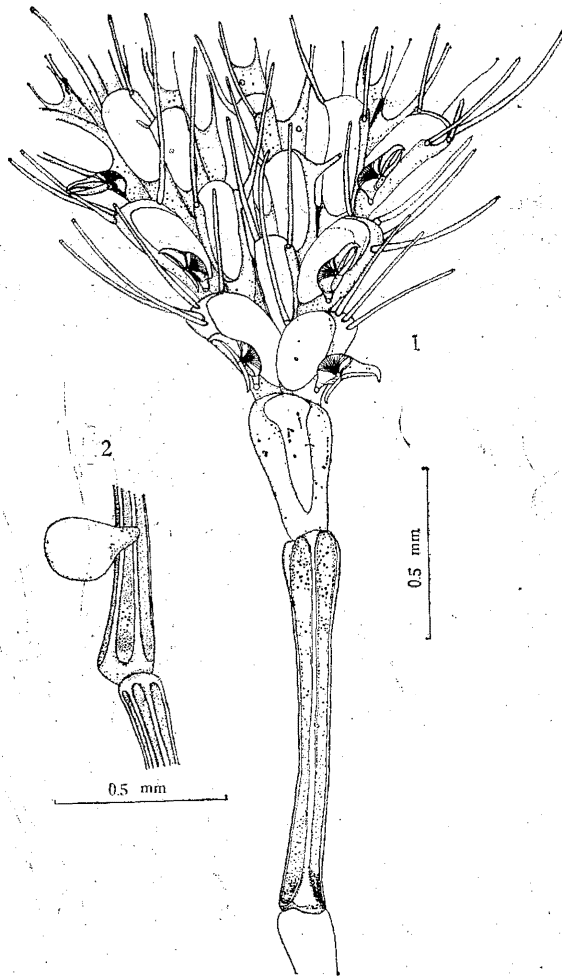


图 27 杯茎苔虫 *Caulibugula caliculata*

1. 前面观, 示末端空个虫、第一个虫、普通个虫、端刺和鸟头体
2. 空个虫及泡状体

分枝始端第一个虫为空个虫,其长度只有一般茎部空个虫的四分之一,但较粗,在其前表面有一开阔区,向始端延长成裂状。据 Levinsen (1909) 的原始描述,第一个虫开阔区的末端两侧有侧刺,但我们的标本未发现侧刺。第一个虫末端背面分出的两个子个虫与其后续个虫相似,但粗短,端刺为 3—1,在始端裸壁上各有一鸟头体。一般分枝个虫细长形,始端较狭,向末端逐渐增宽。前膜宽阔,占个虫前区的四分之三以上。分枝始端部分的个虫端刺为 3—1,或 2—1,或 1—1,末端部分的个虫都为 1—1,内刺极长,往往为

个虫长度的两倍。鸟头体小,鸟头不凸,吻细长,末端呈钩形,颚骨为简单三角形。未发现卵胞。在茎的老成空个虫上常分出附根,这些附根有时匍匐在茎空个虫上,有时游离,有的末端膨大成为梨形泡状体。

标本采集地 琼州海峡,水深 13 米,附在贝壳上。

地理分布 我国香港(英占)、琼州海峡。

附记 本种是由 Levensen (1909)建立的,模式标本产地为我国香港(英占),以后从未有人在别处报道。看来是我国南海近岸特有种。

10. 裸茎苔虫 *Caulibugula inermis* Harmer, 1926 (图 28, 29)

Caulibugula inermis Harmer, 1926:467, pl. 30, figs. 11—13.

我们的标本与 Harmer (1926) 的描述完全相符。在茎苔虫属中,它的长茎最粗壮;在我们的标本中茎的长度有的能达到 55 毫米。茎的末端常分枝。构成茎的空个虫短而粗,但在不同群体(甚至在同一群体的不同分枝)其宽度有较大变化,一般侧枝的空个虫比

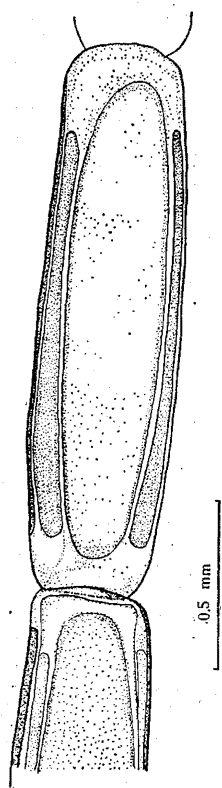


图 28 裸茎苔虫
Caulibugula inermis
的空个虫

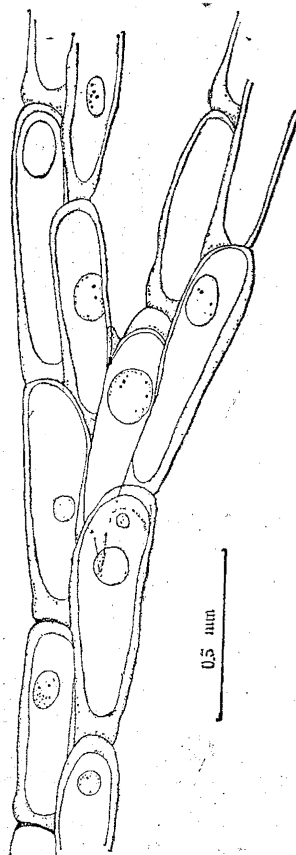


图 29 裸茎苔虫前
面观,示普通个
虫和分枝方式

主茎的狭,但都大大超过分枝个虫的宽度。长茎最始端的一个空个虫膨大成尖梨形结构,并分出许多纤细的附根,这与 Harmer 的原始描述相符。据他记述,附根由茎始端的2—3个空个虫分出,但我们发现茎部始端许多空个虫都分出附根,附根均很纤细,绕在茎的基部,呈毛发状。

分枝由双列个虫构成,其末端的节间部较长,往往由13—15对个虫组成。扇状分枝始端的第一个虫为无刺的空个虫,其形状和一般茎部空个虫相近,但末端较宽,长度只有后者的二分之一。个虫大而细长,两侧几乎平行,皆无刺。前膜宽阔,几占整个前区,仅在始端裸出极短的裸壁。无鸟头体,无卵胞。

在我们的标本中,茎部呈黄色(稻草色),分枝部分常显黄绿色,这是由卵子及虫体的颜色所致。几乎每一个虫都有1—2个黄绿色的卵子。虫体中等大小,呈圆柱形,触手约12根。

标本采集地 东海5个采集站: 30°30'N, 126°00'E, 水深75米; 30°30'N, 126°30'E, 水深82米; 31°30'N, 126°00'E, 水深75米; 31°30'N, 126°30'E, 水深84米; 32°30'N, 125°00'E, 水深70米。每站都取得若干群体,常与水媳、美髯松苔虫生活在一起。

地理分布 爪哇、帕特诺司特群岛 (Paternoster Is.)、新几内亚北端西部。在中国系首次记录。本种从潮间带至水深100米浅海都有分布,似乎为太平洋暖水区的特有种。

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ON GENUS *CAULIBUGULA* VERRILL, 1900, COLLECTED FROM THE CHINESE SEAS*

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ABSTRACT

This paper deals with 10 species of the Genus *Caulibugula* Verrill, 1900 collected from the Chinese seas, with the exception of one species, all are first records and 6 are new species. The 10 species described in this paper are:

1. *Caulibugula dendrograpta* (Waters, 1913)*
2. *C. zanzibariensis* (Waters, 1913)*
3. *C. sinica* sp. nov.
4. *C. binata* sp. nov.
5. *C. longirostrata* sp. nov.
6. *C. longiconica* sp. nov.
7. *C. irregularis* sp. nov.
8. *C. gracilentia* sp. nov.
9. *C. caliculata* (Levinsen, 1909)
10. *C. inermis* Harmer, 1926*

(* recorded for the first time from China)

The type specimens of these new species are preserved in the Institute of Oceanology, Academia Sinica (Qingdao). Descriptions of the new species are given as follows.

1. *Caulibugula sinica* sp. nov. (text-figs. 4—7)

The colony consists of fan-like branches arranged back to back and a long stem consisting of many kenozooids. It is peculiar in this new species that two, instead of one, zooids are situated between the proximal end of the fan-like branches and the distal end of the stem, that is, the first zooid continuous to the stem is not a kenozooid, but a zooid similar to an ancestrula, its frontal membrane being very short. There are four spines jointed at the base around the distal end of the membrane, three of which are on its left side, one on its right, directed toward outer side or distal end. It is connected with the distal end of the stem by an annulation, and followed by the first zooid of the pro-

* Contribution No. 1017 from the Institute of Oceanology, Academia Sinica.

ximal end of the fan-like branches. The last-mentioned zooid is basically similar to its successive branch-zooids in shape but shorter and broader, and has a short frontal membrane. There are three distal spines, the one located on the left side is long and directed obliquely to the proximal end; the longer one located on the right side is situated at the inner margin and obliquely directed distally so as to parallel with the medium axil of the main branch, the shorter one is situated outside and directed to the right side. This shorter spine is nearly at right angle to the inner one. On the dorsal distal end the first zooid gives rise to two daughter zooids arranged back to back and taking part in the bifurcation, the proximal daughter zooid having distal spines being 1—1, the distal one being 2—1. The rest of the zooids have distal spines being 1—1, the inner ones showing the tendency to be reduced. The mode of bifurcation follows that of Harmer's type 4. Owing to the back to back arrangement of the other alternative zooids, the daughter branches are not in the same plane, but arranged back to back. All the ordinary zooids are elongated, broader distally than proximally, their distal border being round or truncate, their inner margin enrolled free.

The frontal membranes are elongated, tapering toward the proximal, occupying about the two thirds of the front. The avicularia are elongate, head not convex, rostrum very narrow, not prominently hooked, mandible elongate triangular; they are situated at a tubercle on the outer side of the proximal gymnocyst. In our specimen, they are mostly absent, but the tubercles are visible. No ovicells are found.

The kenozooids, of which a long stem consists, are expanded slightly at two ends, quadrangular in transverse section. The stems are usually branched, giving off rather slender rootlets from the basal kenozooids, and some of which expand into pyriform vesicles with slender stalks.

This new species is similar to *Caulibugula zanzibariensis* (Waters, 1913). The distinction between the two species are: (1) in the former, there are two zooids between the proximal end of the fan-like branches and the distal end of the stem, one being the first zooid, the other being ancestrula-like; in the latter, only one zooid (the first zooid) is between the proximal end of the fan-like branches and the distal end of the stem, its preceding zooid is the distal kenozooid of the stem. (2) The first zooid of the former has a few spines (three), but one of the latter has 9—11 spines. (3) The vesicles of the former are single and have long stalks, but those of the latter are usually aggregative (sometimes single), having short stalks. (4) The avicularia of the former have less raised head and elongated rostrum (its termination less hooked), while those of the latter have convex head and terminally hooked shorter rostrum.

2. *Caulibugula binata* sp. nov. (text-figs. 8—12)

In this new species the two zooids between the proximal end of the fan-like branches and the distal end of a long stem are twin arrangement instead of the continuous arrangement, their frontal membranes being wide but spineless. Their proximal ends are connected to the distal kenozooid of the stem by a yellow chitinous joint. On their distal end of the dorsal surface they give rise separately to two daughter zooids facing outward and taking part in the bifurcation. The mode of bifurcation is the same as Harmer's type 4. The two daughter branches are arranged back to back and symmetrically at two sides of the main axil of a colony.

The kenozooids are quadrangular in transverse section; as a rule, the distal kenozooid

ids of the stem are broader and shorter, the proximal ones are elongated. The distal portion of the stem usually branched, from the proximal kenozooids are given off slender and dense rootlets, some of which are expanded into ovoid vesicles, which have slender stalks, each with spinous process placed at its opposite end. The fan-like branches are high about one third the height of the colony. The Zooids are slender, elongate, the distal border round, rolled laterally toward the frontal surface of the branch, broader distally, slightly narrow proximally. The Frontal membranes are wide, broader distally than proximally, occupying more than two thirds of the front. The distal spines are rather bulky and long, being 1—1, jointed at the base, as a rule, well developed in the outer rows of the branches, tending to be reduced at their distal ends. The Avicularia are small, situated on a little tubercle of the outer side of the proximal gymnocyst, their profile nearly straight, head not convex, rostrum short and not distinctly hooked, mandible simple, triangular. No ovicells are found.

This new species is somewhat similar to *Caulibugula californica* (Robertson, 1905) in shape of its zooids and in position of attachment of the avicularia and their shape. The latter species has more distal spines, its colony is attached on the substratum by a membranous rootlet-disc, the head of its avicularium is very convex, without vesicles, its primary zooid at the proximal end of the fan-like branches is elongated and rod-like, its entire colony is rather delicate. But the present new species has only a few distal spines, its colony is attached on the substratum by the rootlets, the head of its avicularium is not raised, the vesicles are well developed, the first zooid is not a kenozooid, turbinate, its entire colony is rather robust.

3. *Caulibugula longirostrata* sp. nov. (text-figs. 13—16)

The avicularia of this new species are much elongated, being one half the length of a zooid. The colony consists of a long jointed stem and delicate fan-like branches. The kenozooids are quadrangular in transverse section, with much expanded distal ends. From the basal kenozooids of the stem are given off some rootlets, a few of which are expanded into oblong vesicles with slender and usually curved stalks. The primary zooid of the proximal end of the fan-like branches is a kenozooid, about one third the length of the preceding kenozooid, with expanded distal and gradually tapering proximal end. On the frontal surface of this primary zooid there is an open area, which is broadened distally, attenuated gradually toward its proximal end, and with four fine spines on its sides, three on the left side and one on the right side, directed obliquely to the distal end of the branches. From the distal end of the dorsal surface of this primary zooid are given off two daughter zooids, the proximal one of which does not take part in the bifurcation, the distal one has a long proximal gymnocyst (longer than that of the proximal one), distal one and the one immediately preceding the proximal one are arranged back to back, taking part in the bifurcation. Thus the daughter branches formed after the bifurcation are also arranged back to back. The mode of bifurcation is that of Harmer's type 4. The branch-zooids are elongated, slightly narrow at the proximal end, their distal border round, and enrolled at their sides slightly toward the frontal surface of the branches. The frontal membranes are elongate, extending nearly to the proximal end of the zooid. There is only one outer distal spine jointed at the base. The spines are usually developed in the outer rows of the branches and atrophied to vestigial or entirely wanting in the inner ones. An elongated avicularium is found on the tubercle

at the proximal end of almost every zooid. They are one half the length of a zooid, and directed toward the distal end of the branches, their profile almost straight, and their rostrum is inconspicuously hooked; head is slightly raised, mandible is simple, triangular. No ovicells are found.

This new species is similar to *Caulibugula zanzibariensis* (Waters, 1913) in appearance, but in the latter species the distal spines are longer and numerous, the avicularia have shorter rostra, the first zooid is turbinate and multispinous, and the vesicles are pyriform, aggregate or single. This new species has only one outer spine in its zooid, the rostra of avicularia are elongated, the first zooid is rod-like and has a few spines, the vesicles are oblong, single. It is different from *Caulibugula sinica* sp. nov. in its delicate instead of robust spines, in its much elongate avicularia and delicate habit of the colony.

4. *Caulibugula longiconica* sp. nov. (text-figs. 17—20)

The colony consists of a jointed stem (kenozooids) and fan-like branches. The Kenozooids are almost equal in length and cylindrical in shape, and are straight or slightly curved. From the kenozooids at the base of the stem are given off bushy rootlets of varying coarseness. The distal half of the distal kenozooid of the stem is gradually expanded into an elongate conical form. At its distal frontal surface this elongate conical kenozooid has a cordiform open area (with a pointed end), while at its distal dorsal surface it is jointed with the first zooid at the proximal end of the branches by a root-like process. The first zooid is a kenozooid, similar in shape to its preceding kenozooid, but shorter, has also a cordiform open area (with a round end) at its distal dorsal surface. The first zooid gives rise to the two daughter zooids taking part in the bifurcation (paratype). But in the holotype, between the extremely distal kenozooid of the stem and the first zooid at the proximal end of the branches are also found one or two kenozooids similar in shape to the first zooid, that is, the fourth or fifth zooid distal to the extremely distal kenozooid of the stem taking part in the bifurcation. The mode of bifurcation is that of Harmer's type 4. The branches consist of biserial zooids arranged alternately. The Zooids are elongate conical, distal end slightly broad, proximal end attenuated, outer margin slightly depressed out w rd the inner side, inner margin convex. Frontal membranes are very small, occupying only about one fourth of the front, the proximal gymnocyst thus being extremely well developed. Spines, ovicells and avicularia are wanting.

The zooids of this new species present the features of both the *Bicellariella*-type and *Bugula*-type. Its zooids have short opesia with upturned face distinctive of the *Bicellariella* type, but they are spineless and much elongated, in which respects they are of the *Bugula* type. Therefore, it is an intermediate form between the species with *Bicellariella* type zooids and the ones with *Bugula* type zooids.

5. *Caulibugula irregularis* sp. nov. (text-figs. 21—24)

The colony consists of a jointed stem and fan-like branches. The stem consists of two kinds of kenozooids which are of the same diameter but of different length, the short ones being two thirds the length of the long ones. The junction between the long and the short kenozooids is irregular. These kenozooids are similar to those of *C. caliculata* (Levensen, 1909) in shape, being expanded at their two ends and quadrangular in trasverse section. The stem is usually branched at its distal end. From the proximal

kenozoids are given off the rootlets which are few of number, but bulky. Some of the rootlets are expanded into pyriform vesicles, which are different from those of the other caulibuguloid species in their summit being almost truncate.

The first zooid at the proximal end of the fan-like branches is a kenozooid, and is half the length of a long kenozooid, its distal end is slightly expanded, at its frontal surface is triangular uncalcified area with the round distal margin and the slit-like proximal end. Three short spines are placed at each side of that area and are directed to outer side. The daughter zooids following the first zooid are similar to the other branch-zooids in shape, but are shorter and broader, the distal spines being 2—1 on the proximal one and 1—1 on the distal one. The mode of bifurcation is that of Harmer's type 4. The ordinary zooids are elongated, the distal and middle portions slightly broad, the proximal portion rather narrow and with a round distal end, rolled at their sides slightly toward the frontal surface of the branches. The Frontal membranes are wide, broadest distally and narrowest proximally, occupying more than two thirds of the front. The Distal spines are 2—1 or 1—1, jointed at the base, one of the two outer spines is placed just at the outer distal corner, the other situated at the lateral wall slightly below the distal end. All the spines are jointed at the base, those of the outer rows of the zooids of a branch are well developed, those of the inner ones weak or absent, the distal end of a branch usually spineless. The Avicularia are small, attached on a small tubercle of the outer side of the proximal gymnocyst, their heads more or less convex, elongate rostrum with inconspicuously hooked end, mandible is triangular. No ovicells are found.

This new species is very similar to *Caulibugula californica* (Robertson, 1905). In the latter species the kenozoids placed at the distal portion of a stem are usually shorter than those at the proximal portion, the outer distal corner of its zooids is strongly angulated, the heads of its avicularia are very convex, the rostra are hooked conspicuously at their ends; its colony is attached on the substratum by a membranous rootlet-disc, the ovicells are found on its zooids; but in this new species the junction between its long and short kenozoids is irregular, the outer distal corner of its zooids is round, the heads of its avicularia are less convex, the rostra are inconspicuously hooked at their ends, its colony is attached on the substratum by rootlets, and the ovicells are not found on its zooids.

6. *Caulibugula gracilentia* sp. nov. (text-figs. 25, 26)

The colony is extremely delicate. Stem consists of kenozoids of almost equal length. The kenozoids are very elongate, weakly calcified, expanded at both ends, quadrangular in transverse section. From the basal kenozoids of the stem are given off rather thick rootlets, the diameter of each rootlet is from one third to one half the diameter of a kenozooid. Vesicles are not found.

The primary zooid at the proximal end of the fan-like braches is a kenozooid, which is about one third the length of the preceding kenozooid. It has an uncalcified open area which is broad distally and narrowing toward the proximal end, both sides of this area with three symmetrically arranged lateral spines (jointes at the base) which are directed obliquely outward to the distal end of the branches. At the dorsal surface of its distal end this first zooid gives rise to the two daughter zooids arranged back to back and similar in shape to their succeeding branch zooids. The mode of bifurcation follows

that of Harmer's type 4. The ordinary zooids are elongated, broader distally than proximally, distal border being round, inner margin free, involved toward the frontal surface of the branches. The distal spines are 1—1, jointed at the base, the outer one being long, the inner one being short and usually vestigial or even absent. The frontal membranes are wide, broader distally than proximally, occupying about one half the length of the front. The proximal gymnocyst is narrow and long. The Avicularia are of the small type, attached on the tubercle of the outer side of the proximal gymnocyst; head more convex, rostrum elongated and inconspicuously hooked, mandible simple, triangular. No ovicells are found.

The most conspicuous character of this new species is the very delicate nature of the colony. This is due to the fact that both the kenozooids and the fan-like branches are extremely delicate. It is allied to *Caulibugula mortenseni* Marcus 1925, but the latter species has no distal spines, has pyriform vesicles and ovicells, and the rostra of its avicularia are short. This new species has distal spines and has no vesicles and the rostra of its avicularia are elongate. Its first zooid has six lateral spines arranged symmetrically at the sides of the uncalicified frontal area, but the primary zooid of the latter is spineless.