

TABLE 1
EXPERIMENTAL DATA SHOWING SEX RATIO OF *S. rusticum*
MAINTAINED AT DIFFERENT TEMPERATURES

Temperature (°C)	Clutch no.	No. of newly hatched nymphs	No. of nymphs metamorphosed into adults	No. of males	No. of females	Sex ratio (M:F)
20	1	50	6	0	6	1:5.5
	2	30	4	1	3	
	3	12	1	0	1	
	4	8	2	1	1	
	Total	100	13	2	11	
25	1	50	10	4	6	1:2
	2	25	7	25		
	3	10	3	1	2	
	4	12	4	1	3	
	Total	97	24	8	16	
30	1	40	7	4	3	1:1
	2	30	6	3	3	
	3	25	7	3	4	
	4	30	8	3	5	
	Total	125	28	13	15	
Room temp. (19-35)	1	50	17	8	9	1:1
	2	40	11	5	6	
	3	30	7	3	4	
	4	25	6	4	2	
	Total	145	41	20	21	

It is established that the metamorphosis and attainment of sexual maturity in animals, especially insects, are regulated by hormones. It is likely that the synthesis of hormone is highly temperature dependent. The quantitative study of the hormones in these insects reared at these temperatures would enable us to throw some light on the role of temperature on the determination of sex in insects. It is apparent that the percentage of females would

gradually increase with the lowering of temperature from 30°C to 20 °C.

We thank the Head of the Department of Zoology, Calcutta University, Calcutta, for facilities provided.

December 1, 1989

S.K. RAUT
J.K. ROY

REFERENCES

- BULL, J.J. & VOGT, R.C. (1979) : Temperature dependent sex determination in turtles. *Science* 206 : 1186-1189.
- CHARNOV, L. & BULL, J.A. (1977) : When is sex environmentally determined? *Nature* 266: 828-830.
- CONOVER, O.D. & HEINS, W.S. (1987) : Adaptive variation in environmental and genetic sex determination in a fish. *Nature* 326: 496-498.
- CONOVER, O.D. & KYNARD, E.B. (1981): Environmental sex determination : Interaction of temperature and genotype in a fish. *Science* 213: 577-579.

34. OCCURRENCE OF BIVALVED GASTROPODS IN THE WEST COAST OF INDIA, ARABIAN SEA

The bivalved gastropods are noteworthy for their anomalous shells. Ever since the discovery of the first living representative of the bivalved gastropods, *Berthelinia limax* from Bison Seto, Inland Sea of Japan by

Kawaguti and Baba 1959, establishing its true identity as sacoglossan opisthobranch, many discoveries and descriptions of bivalved gastropods have been published from different parts of the world (Table 1). From Indian

seas, living representatives of the bivalved gastropods have been recorded from Mandapam (Gulf of Mannar) (Prabhakara Rao 1965), Visakhapatnam foreshore (Ganapati and Sarma 1968) on the east coast of India and along the coast of Port Blair, Andaman and Nicobar Islands (Bay of Bengal) (Ganapati and Sarma 1972, Sarma 1975).

While engaged in studies on the phytal faunal associations of foreshore algae off Kovalam beach of Trivandrum on the west coast of India, Arabian sea, two specimens of the bivalved gastropod *Berthelinia* Crosse, were seen among the preserved siphonous green algal samples of *Caulerpa racemosa* C.r. (Forsk) J. Agardh, collected at low water mark. The present find represents the first report of the bivalved gastropods recorded and described from the Arabian Sea.

The two specimens (Figs. 1, 2) measured 1.10 mm and 0.935 mm long, 0.76 mm and 0.701 mm high; 0.526 mm and 0.4425 mm across the paired valves respectively. The shell valves are unequal, unequilateral and ovato-trigonal in outline. The valves are leaf green in colour, covered with a thin transparent periostracum with faint concentric lines of growth. A shining circular adductor muscle impression is seen subcentrally on the shell valves of the two specimens, measuring 0.15 and 0.13 mm in diameter. The protoconchs (Fig. 3) located subcentrally on the left valves are one and one-half whorls, oblique, more discoidal than helicoidal, measuring 0.14 and 0.13 mm high and are closely applied to the dorsal posterior margin of the valves and do not extend on to the right valve.

Inside the shell valves, entirely retracted, lies the animal having a slug-shaped body (Fig. 2). The auriculate rhinophores, neck and foot are uniformly green in colour. Two black eyes are present, one on either side, on an elevation of the neck behind the rhinophores. The oral tentacles are pointed at the corners. The sole of the foot is longitudinally grooved throughout its length.

The present specimens with the whole anterior and dorsal and posterior dorsal margin of the shell forming almost one continuous curve, cannot be identified satisfactorily with any of the bertheliniid species so far described. The detailed description including anatomical observations and comparisons with other known species including naming of the present finding would be published elsewhere. However, a brief comparison of the external shell

morphology of the present specimens with that of already described *Berthelinia* is given below for quick field identification.

The specimens were compared with the preserved specimens of *B. (Tamanhovalva) babai* (Burn 1965) (= *B. typica*, Burn 1960); *B. fijiensis* (Burn 1966); *Midorigai australis* (Burn 1960) and *B. (Edentellina) typica* (Gatliff and Gabriel 1911), which were kindly made available by Robert Burn. *B. (E.) typica* and *M. australis* are readily distinguished by the colour patterns of the valve mantles. *B. (E.) typica* has 5-6 more or less horizontal parallel black pigmented lines. *M. australis* has curved radials of white pigment cells on a dark green background and the present specimens are uniformly green.

Berthelinia (Tamanhovalva) fijiensis (Burn 1966) differs in having a more abrupt anterior margin, a sharper break or curve between dorsal and anterior margin and true straight margin behind the protoconch.

The almost horizontal protoconchs of one and one-quarter and one and one-half whorls distinguish *B. (T.) chloris* Dall 1898 and *B. (T.) pseudochloris* (Kay 1964), respectively from the present find. The almost oval shell and small hidden nucleus of *B. (T.) limax* (Kawaguti and Baba 1959) separate it from the present findings.

B. (T.) ganapatti Sarma, 1975 differs in having a more abrupt anterior margin and longer, straighter posterior margin with small erect protoconch. The shells of *B. (T.) waltirensis* Sarma, 1975 resemble those of the present specimens but differ in having steep and straight posterior margins.

Associated with the bivalved gastropods inhabiting *C. racemosa* are other sacoglossan opisthobranch gastropods belonging to the genera *Cylindrobulla*, *Lobiger* and *Oxynoe*.

We thank Robert Burn, Honorary Associate in Conchology, National Museum of Victoria, Melbourne, Australia, for making available the specimens of Australian bivalved gastropods for comparative studies; late Prof. Dr. M.V. Ramji, former Head, Department of Science, R.C.E, Bhubaneswar, for extending necessary facilities and P.K.S Pillai, post graduate student of our Department for active and enthusiastic assistance while collecting the samples at Kovalam beach.

A.L.N. SARMA
TAPAS CHATTERJEE

July 11, 1990

REFERENCES

- BURN, R. (1960): Australian bivalve gastropods. *Nature* 18: 44-66.
- BURN, R. (1965): Rediscovery and taxonomy of *Edentellina typica* Gatliff & Gabriel, *ibid.* 206: 735-736.
- BURN, R. (1966): The opisthobranchs of a caulerpan microfauna from Fiji. *Proc. malac. Soc. Lond.* 37: 45-65.
- DALL, W.H. (1898): Contributions to the Tertiary fauna of Florida with special reference to the Miocene Siliceous beds of Tampa and the Pliocene beds of Calosahatchie River. Part-IV. *Trans. wagner Free. Inst. Sci.* 3: 1-200.

TABLE I
AVAILABLE RECORDS OF LIVING REPRESENTATIVES OF BIVALVED GASTROPODS WITH THE ALGAL HABITAT THROUGHOUT
THE WORLD SEAS

Species	Habitat	Locality	Author
<i>Berthelinia (Tamanovalva) limax</i>	<i>Caulerpa okamurai</i>	Bisan Seto, Inland Sea of Japan.	Kawaguti & Baba 1959
<i>Midorigai australis</i>	<i>C. brownii</i> <i>C. scalpelliformis</i> <i>C. simpliciuscula</i>	Torgay, Victoria, Australia	Burn 1960
<i>B. (Tamanovalva) chloris</i>	<i>C. sertularioides</i> <i>C. racemosa</i>	Puerto Ballandro Bay, Baja California	Keen & Smith 1961
<i>Julia</i> sp.	—	West side of Saipan, Marina Islands.	Morrison 1961
<i>Midorigai australis</i>	In plankton twos made through <i>Posidonia</i> sp.	Port Hacking, Australia	Wisely 1960
<i>Julia japonica</i>	<i>Microdictyon japonicum</i> , <i>Caulerpa ambigua</i>	Mishima, off the coast of Hagishi Yamaguchi Prefecture, Japan	Kawaguti & Yamasu 1962, 1966
<i>Julia exquisita</i>	On an algal mat of <i>Laurencia</i> , <i>Gracilaria</i> and <i>Gracilariopsis</i>	Koloa, Kauai, Hawaii	Kay 1962
<i>Berthelinia (Tamanovalva)</i> <i>caribbea</i>	<i>Caulerpa verticellata</i>	Port Royal, Jamaica	Edmunds 1963
<i>B. (Tamanovalva) pseudochloris</i>	<i>C. racemosa</i>	Koloa, Kauai, Hawaii	Kay 1964
<i>B. (Tamanovalva) babai</i> (= <i>B. typica</i> Burn 1960)	<i>C. scalpelliformis</i> <i>C. brownii</i>	Torgay, Victoria, Australia.	Burn 1965.
<i>B. (Edentellina) typica</i>	<i>C. brownii</i>	Flinders, Victoria, Australia.	Burn 1965
<i>B. (Tamanovalva) limax</i>	<i>C. racemosa</i>	Mandapam Camp, Gulf of Mannar, India	Prabhakara Rao 1965
<i>B. (Tamanovalva) sp.</i>	<i>Caulerpa</i> sp.	Tulear, Madagascar	Legendre 1965
<i>B. (Tamanovalva)</i> <i>caribbea</i>	<i>C. verticellata</i> <i>C. racemosa</i>	Puerto	Rico Warmke 1966
<i>B. (Tamanovalva)</i> <i>fijiensis</i>	<i>C. racemosa</i>	Vitilevu, Fiji	Burn 1966
<i>Berthelinia</i> sp.	<i>C. racemosa</i> , <i>C. taxifolia</i>	Visakhapatnam, coast Bay of Bengal, India	Ganapati & Sarma 1968
<i>B. (Tamanovalva)</i> <i>caribbea</i>	<i>C. verticellata</i>	Port Royal, Jamaica	Grahame 1969
<i>B. (Tamanovalva) limax</i>	<i>C. racemosa</i>	Visakhapatnam coast, Bay of Bengal, India	Ganapati & Sarma 1972
<i>B. (Tamanovalva)</i> <i>schlumbergeri</i>	<i>Halimeda opuntia</i>	Port Blair, Andaman Islands	Ganapati & Sarma 1972
<i>B. (Tamanovalva) waltirensis</i>	<i>Caulerpa taxifolia</i>	Visakhapatnam coast, Bay of Bengal, India	Sarma 1975
<i>B. (Tamanovalva) ganapatii</i>	<i>C. racemosa</i>	Visakhapatnam coast, Bay of Bengal, India	Sarma 1975
<i>Julia burni</i>	<i>Halimeda opuntia</i>	Port Blair, Andaman Islands	Sarma 1975
<i>Berthelinia</i> sp.	<i>Caulerpa racemosa</i>	Kovalam beach, Kerala, Arabian Sea, India	Present report

- EDMUNDS, M. (1963): *Berthelinia caribbea* n. sp., a bivalved gastropod from the West Atlantic. *J. Linn. Soc. Lond. (Zool.)* 44: 731-739.
- GANAPATI, P.N. & SARMA, A.L.N. (1968): Occurrence of bivalve gastropods (Mollusca) in Visakhapatnam shore. *Curr. Sci.* 37: 689-690.
- GANAPATI, P.N. & SARMA, A.L.N. (1972): Bivalve gastropods of the Indian Seas. *Proc. Ind. Nat. Sci. Acad.* 38-B: 240-250.
- GRAHAME, J. (1969): The biology of *Berthelinia caribbea* Edmunds. *Bull. Mar. Sci.* 19: 868-879.
- KAWAGUTI, S. & BABA, K. (1959): A preliminary note on a two-valved sacoglossan gastropod *Tamanovalva limax* n. gen., n. sp., from Tamano, Japan. *Biol. J. Okayama Univ.* 5: 177-184.
- KAWAGUTI, S. & YAMASU, T. (1962): *Julia japonica* found living as a bivalve gastropod. *Proc. Japan. Acad.* 38: 284-287.
- KAWAGUTI, S. & YAMASU, T. (1966): Feeding and Spawning habits of a bivalved gastropod, *Julia japonica*. *Biol. J. Okayama Univ.* 12: 1-9.
- KAY, E.A. (1962): *Julia exquisita* Gould, a bivalved gastropod. *Pacif. Sci.* 16: 434-435.
- KAY, E.A. (1964): A new species of *Berthelinia* and its associated sacoglossans in the Hawaiian Islands. *Proc. malac. Soc. Lond.* 36: 191-197.
- KEEN, A.M. & SMITH, A. (1961): West American species of the bivalved gastropod genus *Berthelinia*. *Proc. Calif. Acad. Sci.* 30: 47-66.
- LEGENDRE, R. (1965): Presence dans Les eaux Littorales de Madagascar dde Gastropodes Bivalves (opisthobranches - Tectibranches, Sacoglosses). *Bull. Aca. Malgache, N.S.* 41: 89-91
- MORRISON, J.P.E. (1961): Notes on the bivalved 'Univalves'. *Abstract of the American Malacological Union Annual Reports for 1960*: 18-20.
- PRABHAKARA RAO, K. (1965): Record of bivalve gastropod *Berthelinia limax* (Kawaguti and Baba 1959) from the Indian Ocean. *Nature* 208: 404-405.
- SARMA, A.L.N. (1975): Three new species of the Bivalved Gastropods *Julia* and *Berthelinia* found in eastern Indian Ocean. *Jap. Jour. Malac. (Venus)* 34: 11-25.
- WARMKE, G.L. (1966): Two species of the bivalve gastropod, *Berthelinia*, found in Puerto Rico. *Nautilus* 79: 139-141.
- WISELY, B. (1960): An outline of the development of the bivalve gastropod, *Midorigai australis* Burn. *J. Malac. Soc. Aust.* 6: 37-39.

35. EXTENSION OF RANGE OF A FRESHWATER LEECH *BARBRONIA WEBERI* (BLANCHARD) (ARHYNCHOBDELLAE:ERPOBDELLIDAE) FROM PUNE, MAHARASHTRA

A handful of aquatic vegetation, mainly *Marsilea*, collected from the marshy banks of the river Mutha, near Balgandharva Ranga Mandir in Pune, Maharashtra, disclosed the presence of eight small leeches. These were red in colour and swam actively when placed in an aquarium. Detailed examination after preservation indicated that the species was *Barbronia weberi* (Blanchard), as per the key given by Chandra (1983).

Diagnostic features: Slender, linear form; terete anterior end; flattish posterior end; small, round caudal sucker and distinct clitellum. The specimens also compared well with the full description given by Harding and Moore (1927). One of the collected specimens, however, measured 49 mm. Harding and Moore mentioned the size "...to be 25 to 35 mm, the largest being 36 mm...." Interestingly it was the smaller specimen (30 mm) that showed a well-developed male genital pore and the so-called anterior and posterior accessory copulatory pores. In the 49 mm specimen, the posterior pore was not well marked. Such variations have also been mentioned by Harding and

Moore (1927).

This species has so far been reported only from the northern parts of India, viz. Jammu and Kashmir, Himachal Pradesh and Madhya Pradesh (Harding and Moore 1927, Chandra 1983). In fact, no member of the family Erpobdellidae was reported from Maharashtra until fairly recently, when two species of the genus *Herpobdelloidea* were reported (Chandra 1976). This report therefore considerably extends the range of *Barbronia weberi*

I am grateful to Dr. Mahesh Chandra (Zoological Survey of India, High Altitude Zoology Field Station, Solan) for examining the specimens and for reading the first draft of this manuscript. Shigwan and Varushe, Field Collectors of the Botany Department, had first brought these animals to my notice and I am thankful to them for their help. Thanks are also due to the authorities of Modern College for encouragement and facilities.

December 24, 1990

H.V GHATE

REFERENCES

- CHANDRA, M. (1976): On a small collection of leeches from Maharashtra State, India. *Rec. Zool. Surv. India* 69: 325-328.
- CHANDRA, M. (1983): A checklist of leeches of India. *Rec. Zool. Surv. India* 80: 265-290.
- HARDING, W.A. & MOORE, J.P. (1927): Fauna of British India, including Ceylon and Burma: Hirudinea. Taylor and Francis, London.



Sarma, A. L. N. and Chatterjee, Tapas. 1991. "Occurrence of bivalved gastropods in the west coast of India, Arabian Sea." *The journal of the Bombay Natural History Society* 88, 130–133.

View This Item Online: <https://www.biodiversitylibrary.org/item/190685>

Permalink: <https://www.biodiversitylibrary.org/partpdf/156645>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder

License: <http://creativecommons.org/licenses/by-nc/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.