The expression for the current, using Ohm's law, will be

$$J_0 = \frac{2\sigma}{\pi}\,\phi_w\,\eta' - \left(\frac{\rho_0}{\rho}\right)^{\frac{1}{2}}\sigma\,UBx. \qquad (18)$$

For large η' along $x = \pi/2$, equation (12) becomes

$$e^{\eta} = \tfrac{1}{2}\,e^{\eta'} \qquad (19)$$

and hence

$$\eta' = x + \log 2. \qquad (20)$$

If the channel length is L, the total current to the electrodes per unit length in the direction of the magnetic field is

$$J_L = \sigma\left[\frac{2\phi_w}{h} - \left(\frac{\rho_0}{\rho}\right)^{\frac{1}{2}} UB\right] L + \frac{4}{\pi}\,\sigma\phi_w \log 2. \qquad (21)$$

The efficiency of the power generator is given by

$$\epsilon_g = \frac{\text{Power output}}{\text{Flow work}}$$

$$= \frac{2\phi_w\left[L\left\{\frac{2\phi_w}{h} - \left(\frac{\rho_0}{\rho}\right)^{\frac{1}{2}} UB\right\} + \frac{4}{\pi}\log 2\right]}{UBLh\left(\frac{\rho_0}{\rho}\right)^{\frac{1}{2}}\left[\frac{2\phi_w}{h} - UB\left(\frac{\rho_0}{\rho}\right)^{\frac{1}{2}}\right]}. \qquad (22)$$

If $L \to \infty$, the end losses become negligible and the efficiency becomes

$$\epsilon_g = \frac{2\phi_w}{UBh}\left(\frac{\rho}{\rho_0}\right)^{\frac{1}{2}}. \qquad (23)$$

We conclude that using an heterogeneous conducting fluid, the total current per unit length in the direction of the magnetic field, the power output and efficiency are increased.

1. Sutton, G. W. and Carlson, A. W., "End effects in inviscid flow in a magnetohydrodinamic channel," *J. Fluia. Mech.*, 1961, **2**, 121.

2. Rudraiah, N., "Magnetohydrodynamic stability of Heterogeneous dissipative conducting liquids," *Appl. Sci. Res. Sec. B*, 1964, **2**, 180.

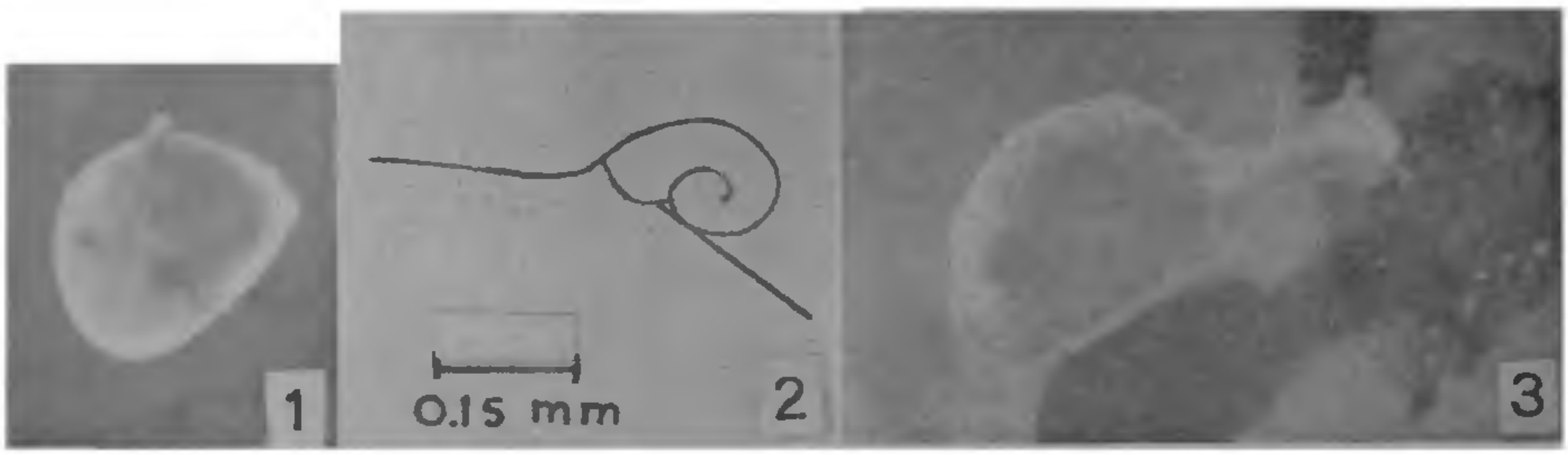
OCCURRENCE OF BIVALVE GASTROPODS (MOLLUSCA) IN VISAKHAPATNAM SHORE

P. N. GANAPATI AND A. L. N. SARMA
Department of Zoology, Andhra University, Waltair

THE bertheliniids were considered to be an extinct group of bivalve molluscs until Kawaguti and Baba[1] discovered the first living representative of the group *Tamanovalva limax* from Bison Seto, Inland Sea of Japan. The above authors established the true identity of this group as 'bivalve gastropods' with a protoconch and a typical Opisthobranch Sacoglossan radula. Ever since the description of this genus *Tamanovalva* by Kawaguti and Baba there has been a growing interest and an intensive search for the occurrence of these forms in other parts of the world. In recent years as many as eleven species of bivalve gastropods belonging to two families and four genera have been reported from different parts of the world, Australia, California, Hawaii, Jamaica and Puerto Rico. As many as 8 of these belong to the genus *Tamanovalva*. The only previous report of a bertheliniid from Indian waters was by Prabhakara Rao[2] who obtained four specimens of *Tamanovalva limax* from the green alga *Caulerpa racemosa* from Mandapam, Gulf of Mannar on the east coast of India. In the present communication the authors report the occurrence of three species of *Tamanovalva* of undetermined identity, one from *Caulerpa taxifolia* and two from *Caulerpa racemosa*. The specimens were discovered in the course of our studies on the systematics and ecology of invertebrate animals associated with the algal vegetation on our foreshore.

A single specimen of *Tamanovalva* sp. was found on the fronds of the siphonous green alga, *Caulerpa taxifolia* collected from the low watermark. The shell is fragile and leaf-green in colour and measured 2·5 mm. in length and 1·95 mm. in height. Faint growth lines were visible on the shell and the periostracum was transparent (Fig. 1). The adductor muscle impression is circular and subcentral. The protoconch or nucleus on the left valve is one and one-half whorls, sharply set of from the rest of the body by its pearly white colour (Fig. 2).

Five more specimens of *Tamanovalva* were recovered from the fronds of *Caulerpa racemosa* of which one was alive. The live specimen (Fig. 3) which measured 8·5 mm. in length, when fully extended, was found attached to the fronds of the alga which it resembled closely in shape and colour. The shell is semicircular and measured 6·6 mm in length and 5·0 mm. in height. The shell is obese with a subcentral blush-yellow large circular adductor muscle impression. The protoconch was not present and it is presumed to have been lost accidentally. Above the adductor muscle impression are two bright



FIGS. 1–3. Fig. 1. Photograph of *Tamanovalva* sp. (*left side*) showing protoconch. Fig. 2. A magnified view of the umbone showing the protoconch. Fig. 3. Photograph of living animal with the head extended showing the rhinophores.

shining yellow patches of pigmentation in the mantle irradiating through the transparent shell valves. The surface of the shell at the umbones and the anterior region appeared rough and granular. Yellow rays are present on the shell. The animal having a slug-shaped body survived in the laboratory for 25 days. The rhinophores are short and slender and auriculate. The rhinophores, neck and foot are uniformly yellow in colour and the tips of the rhinophores are speckled with white spots. Two black eyes are present one on either side on an elevation of the neck behind the rhinophores. The oral tantacles are lobiform. The sole is flat and longitudinally grooved throughout its length. The foot is rounded in front, but tapers behind as tail extending to the posterior margin of the shell. When disturbed or irritated with a needle, the animal ejected dense white viscous hypobranchial gland secretion. The animal was found to feed on the fronds of the alga with its rasping radula. Locomotion is effected by the occasional dragging of the shell by the head part. The animal always leaves behind mucous thread on its track.

Associated with the bivalve gastropods were other sacoglossan Opisthobranch gastropods belonging to taxa *Volvatella, Cylindrobulla, Oxynœ, Lobiger, Elysia.*

The specimen of *Tamanovalva* recovered from *Caulerpa taxifolia* and another from *Caulerpa racemosa* were examined by Dr. Robert Burn, Honorary Associate in Conchology, National Museum of Victoria, Melbourne and he is of the view that both the forms may turn out to be two new species of *Tamanovalva* as they do not agree with any of the described species of the genus in all their features. A full description of these forms and the associated animals will be presented elsewhere.

We wish to express our very grateful thanks to Dr. Robert Burn who readily examined the specimens and for his very helpful suggestions. One of us (A. L. N.) is indebted to the Council of Scientific and Industrial Research for the award of a Research Fellowship during the tenure of which the present work was undertaken.

1. Kawaguti, S. and Baba, K., *Biol. J. Okayama Univ.*, 1959, **5**, 177.
2. Prabhakara Rao, K., *Nature*, 1965, **208**, 404.

POLLEN GERMINATION AND FORMATION OF CALLOSE PLUGS IN PAPAYA POLLEN TUBES

LOW LEE ENG AND A. N. RAO
Department of Botany, University of Singapore, Singapore

IN the last two decades considerable interest has developed in pollen germination studies. The effect of growth substances on both percentage germination and pollen tube growth forms one of the major aspects of such studies. Recent reviews have summarized the individual papers pointing out the more important facts.[1,2] Some of the significant observations on pollen germination and tube growth of *Carica papaya* (Variety—Hawaiian breakfast) and the effects of certain growth substances on these processes are summarized in this paper.