Letters to the Editor.

The Multiple Testis of *Ichthyophis glutinosus*.

ACCESSORY testicular lobes have been reported from Urodela, Gymnophiona and Anura and while the origin, nature and significance of these bodies have been subjected to very critical examination in many urodeles and some anura, literature does not show any reference to the multiple nature of the testis in Gymnophiona. Nussbaum[1] who was one of the first to describe the segmented nature of the testis in several species of urodeles, correlated the degree of development of the multiple testis with the time of the year and the age of the animal. Champy[2] thought that the segmented condition of the testis was due to the elongation of the body of the animals. Kingsbury[3] found the lobed testis more common in adults than in young ones of *Desmognathus fusca*. A new explanation of this phenomenon was given by Humphrey[4] who, following Spengel[5] thought that the regular caudo-cranial development of the germ cells and their very slow ripening in many urodeles have resulted in this segmented condition of the testis. It is to be remembered that in most of these cases, especially those examined by Humphrey[4] in between the lobes of the testis an abundance of germ cells is found and no part of the testis is entirely free from them.

In marked contrast with the urodeles is the condition found in the Gymnophiona. As far back as 1876 Spengel[5] noticed the entire absence of germ cells between the segments of the testis. And unlike urodeles even in an immature animal the testis shows segmentation and I have reasons to believe that after a certain age, the number of the testis lobes does not increase in the animal.

Obreshkove[6] in a recent communication on the multiple testis of *Diemyctylus viridescens* gives a different explanation as to the origin of the multiple testis in this animal. He finds the lobed condition even in immature animals and in addition to the regular and connected system of testis segments certain isolated germ cell groups are found, sometimes not in the direct axial line of the germ cord, which have led him to conclude that the multiple condition of the testis in *Diemyctylus viridescens* has arisen from distinct rudiments unconnected with one another. Peritoneal cells are in this animal capable of giving rise to islands of germ cells. This explanation of Obreshkove, though refuted by Humphrey[7] in a later communication, offers, I believe, an approach to the correct understanding of the subject of multiple testis in Gymnophiona. Distinct germ cell proliferations appear independently along the sex cord and these at first are in the nature of solid masses of rounded cells traversed in the centre by a duct. It can be distinctly seen that the germ cells have aggregated to form nests, which, when the testis capsules are formed as outgrowths from the duct, migrate into them.

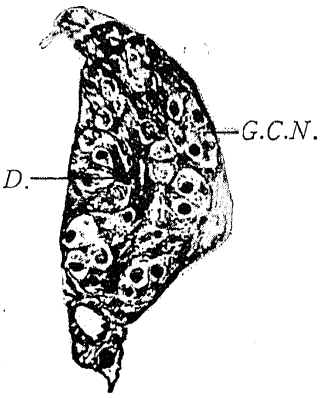

Fig. 1.

Longitudinal Section of a testis lobe of the larva of *Ichthyophis glutinosus* measuring 11·5 cms.

D.—Duct.
G.C.N.—Germ cell nests.

In the latest contribution to the subject of the anatomy of the testes of Gymnophiona, Tonutti[8] reports that in *Hypogeophis*, the anterior testis lobes are generally larger than the posterior ones. He thinks that some of these anterior larger lobes are formed by the fusion of two originally distinct ones. In *Ichthyophis*, however, I cannot make out any such fusion nor can I trace, with definiteness, any regular transitional difference in size between the anterior and posterior lobes. The posterior lobes in many cases are as large as and sometimes even larger than the anterior ones.

It will be recognised that the indefiniteness in the number of the testis lobes in

[1] Nussbaum, M. *Arch. fur Mikr. Anat.*, **68**, 1, 1906.
[2] Champy, C. *Archiv. de Zool. Exper. et Gen.*, **52**, 13, 1912.
[3] Kingsbury, B. F. *Amer. Journ. Anat.*, **1**, 1901.
[4] Humphrey, R. R. *Biol. Bull.*, **43**, 45, 1922.
[5] Spengel, J. W. *Arb. aus dem Zool. Zootom*, **3**, 1, 1876.
[6] Obreshkove, V. *Journ. Morph.*, **39**, No. 1, 1, 1924.
[7] Humphrey, R. R. *Journ. Morph.*, **41**, No. 2, 283, 1926.
[8] Tonutti, E. *Morph. Jahrb.*, **68**, 151, 1931.

different animals and on the two sides of the same individual will have to be explained adequately. The factor that determines or influences the development of the individual number of the testis lobes is not known, and it seems to me that individual and lop-sided variations have no specific or physiological significance.

B. R. SESHACHAR.

Department of Zoology,
Central College, Bangalore,
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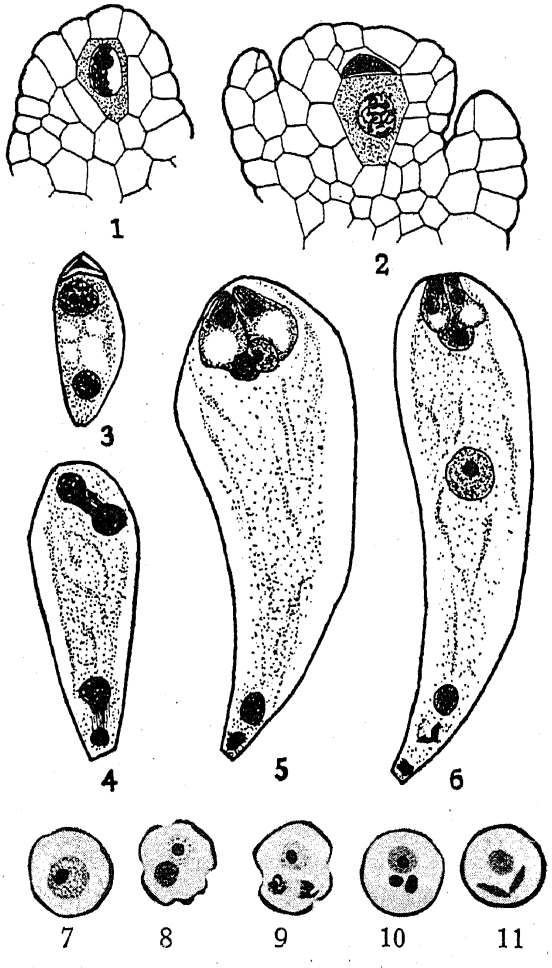
Contribution to the Morphology of *Limnophyton obtusifolium* Mzq.

PLANTS of the family *alismaceæ* have been investigated by several workers, each obtaining somewhat different results from the other. Schaffner worked out *Alisma plantago* in 1896 and *Sagittaria latifolia* in 1897 and reported an eight-nucleate embryo sac. Dhalgren in 1928 worked out *Alisma plantago* and a few other genera



of the family and finds a six-nucleate embryo sac.

A considerable quantity of material of *Limnophyton obtusifolium* was collected from Bharatpur to obtain a close series of stages giving the development of the female gametophyte. The flowers are borne in 4-5 whorls on a long peduncle. They are of two kinds either purely male or hermaphrodite. Hermaphrodite flowers occur in larger numbers in the lower whorls and are fewer in the upper ones. There are six stamens and numerous free carpels.

Female gamelophyte : There is a hypodermal archesporial cell (Fig. 1) which functions directly as the mother cell without cutting off a wall cell. After the first reduction division is completed; it divides into two cells of which the upper degenerates early (Fig. 2) and the lower divides twice and produces a four-nucleate embryo sac (Figs. 3 and 4). Two nuclei are at the chalazal end and two are at the micropylar end. The former do not divide further, and the micropylar nuclei divide but once producing four nuclei. The mature embryo sac is thus six-nucleate (Fig. 5). There is the usual egg-apparatus; one of the group of the four micropylar nuclei functions as the upper polar nucleus; and of the two lower, one is the lower polar nucleus and the other represents the single antipodal nucleus. This is the smallest nucleus of all the nuclei in the embryo sac and soon degenerates. The difference in the size of this nucleus as compared with the others can be seen even at the four-nucleate stage. The upper polar descends down to meet the lower polar in the middle of the embryo sac (Fig. 6).

Male gametophyte : A single row of hypodermal cells in each anther lobe, as is usually described for other plants, is not distinguishable. A group of sporogenous cells differentiates in each lobe and the outer cells differentiate into a tapetum, which gives rise to a true periplasmodium. The microspore mother cells undergo two successive divisions to form isobilaterally arranged tetrads. The microspore nucleus (Fig. 7) divides producing a large tube and a smaller generative nucleus (Fig. 8). The latter again divides (Fig. 9) producing two spherical male nuclei (Fig. 10), which later become spindle shaped (Fig. 11). The mature pollen grain is thus tri-nucleate.

Embryo : The development of the embryo follows the usual course laid down for the monocots. The basal cell is very large and conspicuous. The endosperm is of the Helobiales type.