SUMMARY AND CONCLUSION

The land snail *Macrochlamys petrosa* (Hutton) is a representative of the order Stylommatophora of the family Ariophantidae. This snail found distributed in the vicinity of Aurangabad. It seems to be a voracious feeder, because after emergence from the aestivation conditions, found attacking on various plants growing at its habitat. The snails are found during rainy season and available up to the month of November there after they undergo aestivation up to next monsoon.

In the present investigation entitled “Reproductive physiology of the stylommatophoran land snail *Macrochlamys* from Aurangabad Region, M.S.” an attempt has been made towards understanding of reproductive physiology of this snail. Practically nothing is known about the breeding biology and reproductive cycle of this snail. The work has been presented through four chapters besides preface.

The first chapter deals with reproductive physiology of the snail M. petrosa. It includes histomorphology of the reproductive system, the process of gametogenesis, annual reproductive cycle of the snail and effect of bilateral optic tentaclectomy on Gametogenesis. The present snail is a protandrous hermaphrodite snail having seasonal breeding pattern during annual reproductive cycle. After having sufficient rain during monsoon
reason, these snails comes out of aestivating conditions, them starts the breeding of these snails. The process of breeding is continued till end of September when egg laying is completely stopped.

The reproductive system of *M. petrosa* is composed of common hermaphrodite gonad or having made up of 5 to 8 lobes. The gonadal lobes are arranged in a line of successions, anterior one is largest and posterior most is smallest in size. The number of lobes increases during peak breeding period of the snail. Each gonadal lobe looks like bunch of grapes, i.e. made up of oval or circular or irregular shaped hermaphrodite follicles. The number of follicles in each lobe varies, maximum in anterior and minimum in posterior lobes. Each follicle has small ductules, which joins together or open to form common hermaphrodite duct. The middle portion of hermaphrodite duct becomes dialated and bears a number of small diverticula within which sperms are stored are called seminal vesicles. At the region of Carrefour male and female reproductive system gets separated. A pale yellow coloured, multilobed prostate gland remains loosely associated with spermoviduct. The prostatic duct opens in to the vas deferens. The common spermoviduct divides into two specific ducts, a narrow vas deferens and wider thick oviduct. The penial complex is a highly muscular tube can be everted at the time of copulation. Extracted
penis is with drawn back into the body by a specialized muscle, the penial retractor. The penis joins the vagina to form a short common chamber which opens to the exterior through. The common gonopore present at the base of right cephalic tentacle. Female reproductive tract consists of fertilization pouch, albumen gland, spermoviduct, uterus, bursa copulatrix and vagina. Albumen gland is single bulbous with dirty yellowish in colour. Bursa copulatrix is important characteristic of all stylommatophoran snails, it is also present in *M. petrosa*.

In *Macrochlamys* both gametes are formed with in same gonadal follicles. The process of spermatogenesis comprises of five distinct stages Viz. spermatogonia, primary and secondary spermatocytes, spermatids and spermatozoa. The male phase maturation, is about to complete, there starts appearance of oogonial cells within hermaphrodite follicles. The process of oogenesis completed with five different stages of oocytes developments viz. oogonia, primary and secondary oocyte, Previtellogenic oocytes and vitellogenic oocytes.

Annual reproductive or gametogenic cycle divides into pre-reproductive(June-July),reproductive(August-September),Post reproductive (October-November) and reproductively quiscent (aestivation) period (December to May).
Bilateral optic tentaclectomy shows drastic changes in histomorphology and Gametogenesis activity of the snail. After optic tentaclectomy there is disturbances in regular spermatogenic activity simultaneously, there is enhanced rate of vitellogenesis these by resulting release of vitellogenic ova.

The second chapter includes biochemical studies of different body components of the snail viz. hepatopancreatic gonadal complex, albrumen gland, mantle and foot. The different organic metabolites such as total proteins, glycogen and total lipids were estimated during different breeding activity periods of the snail *Macrochlamys* seasonal variation in the water percentage in the whole body is also estimated. The water percentage varies from 68.62 to 85.30 % Maximum percentage of water present in reproductive period (August - September) is (85.30 ± 3.900) and minimum in pre-reproductive period (June-July) is (68.62 ± 2.341). Maximum amount of glycogen is present in hepatopancreatic gonadal complex (26.24± 1.15) and minimum in the albumen gland (6.00 ± 0.80). Glycogen accumulation is Maximum in pre-reproductive period, which is pre-mating phase of the snail. Protein content of hepatopancreatic gonadal complex in the pre-reproductive period is 67.23 ± 1.19, this is high amount of proteins observed as compared to other tissues. The maximum amount of lipids in
foot are observed in reproductive period (12.38 ± 1.38), in hepatopancreatic gonadal complex lipid content was maximum in pre-reproductive period (19.86 ± 2.77) and minimum is (12.79 ± 1.18) in post-reproductive period. In *M. petrosa* a consistent decrease in lipid levels of tissues studied during the progress in the normal aestivating cycle of the snail.

The third chapter deals with the neuroendocrine system of the snail. *M. petrosa*. It includes morphology of neuroendocrine system and histology of different central ganglia and associated endocrine glands, neurosecretory activity of cerebral ganglion cells and dorsal body cells (endocrine organ) and their possible role in regulation of reproductive cycle is worked out. In addition, optic tentacular neurosecretion and its probable role in regulation of reproduction is also observed. In *Macrochlamys petrosa* the neurosecretory cells are present in all central ganglia of circumoesophageal ring. This ring is located at the base of buccal mass surrounding the anterior oesophageal part of the oesophagus. It consists of two parts, dorsal to oesophagus supra-oesophageal ring and ventrally sub oesophageal ring. Supra-oesophageal ring is composed of two paired buccal and cerebral ganglia. The buccal ganglia are very small, oval in shape and located at the base of buccal mass. Cerebral ganglia are oblong in shape, located
overlapping to pedal ganglia. These ganglia remain attached with pedal on either side of each ganglion by two stout cerebropedal connectives. Suboesophageal ring having made up of paired pedal, pleural, parietal ganglia and single visceral ganglion. Compared with other ganglia, pedal ganglia are large in size. Pedal ganglia remains attached to pleural ganglia in the posterior region by pleuropedal connectives on either sides of the ring. A statocyst is present in the postero-dorsal part of the pedal ganglion. Right pleural ganglion is larger than left one. Left parietal ganglion is similar in size of pleural ganglion. Unpaired visceral ganglion is remains attached to left and right parietal ganglia. Visceral ganglion is larger in size, except pedal ganglion.

Three distinct groups of neurosecretory cells are present in cerebral ganglion, these are MDC, CDC and LDC. Each group is having two distinct types of neurosecretory cells. i.e. type ‘A’ and type ‘B’. Neurosecretory cell type ‘A’ are larger sized with oval to oblong in shape of the cell body. In *M. petrosa*, their cell nuclear diameter measures 75 to 83 μ and 62 to 70 μ respectively. Neurosecretory cell type ‘B’ are small in size and more in number compared with type ‘A’. Type ‘B’ cells cell and nuclear diameter measure 42 to 55 μ and 30 to 37 μ respectively.
Peripheral part of the cerebral commissure at the juncture of medio-dorsal body shows similar type of stains like neurosecretory material may probably the storage site of neurosecretory material released from mediodorsal cells of cerebral ganglia. The other such types of areas are noticed in the peripheral regions of median lip nerve of cerebral and visceral nerve indicative of neurohaemal areas.

Optic tentacle of *M. petrosa* shows presence of an eye or optic bulb, distinct tentacular ganglion. The collar cells of optic tentacle are large and secretory in nature. These cells involved in the formation of tentacular hormone optic tentacular cells shows ceased secretory activity during post-reproductive type.

In fourth and last chapter, distribution pattern, substratum preference, food preference and feeding behaviour of *M. petrosa* is studied in laboratory and natural habitat of the snail. Different chemical agents and common molluscicides have been used to test the mortality and survival rate of snails under laboratory conditions as chemical control. The Macrochlamys were abundantly found in gardens during peak rainy season. It is observed that, these snail feeds on a under variety of plants and found to prefer soft and green vegetables as compared to other plants. On
the revival of the favourable conditions which were followed by a rainfall in the month of June -July, snails are comes out from aestivation period.

It was observed that during the night period these snails were more active as compared to their day time activities. In laboratory experiment it is observed that, the most snails prefers moist soil substratum. Sandy area was avoided by snail, because in its natural habitat sandy areas are absent.

Artificial control of snail by using some common molluscicides was observed in laboratory conditions. For these experiments three methods are used, dusting of powder of chemicals on snails, mixing the chemicals with soil, and sprinkling the liquid concentrations of chemicals on food of snail. It is observed that direct dusting powder of chemicals on snails and sprinkling the liquid concentration of chemicals on food of snail are most effective control methods. Among used chemicals copper sulphate is most effective molluscicide for artificial control of *Macrochlamys*. 