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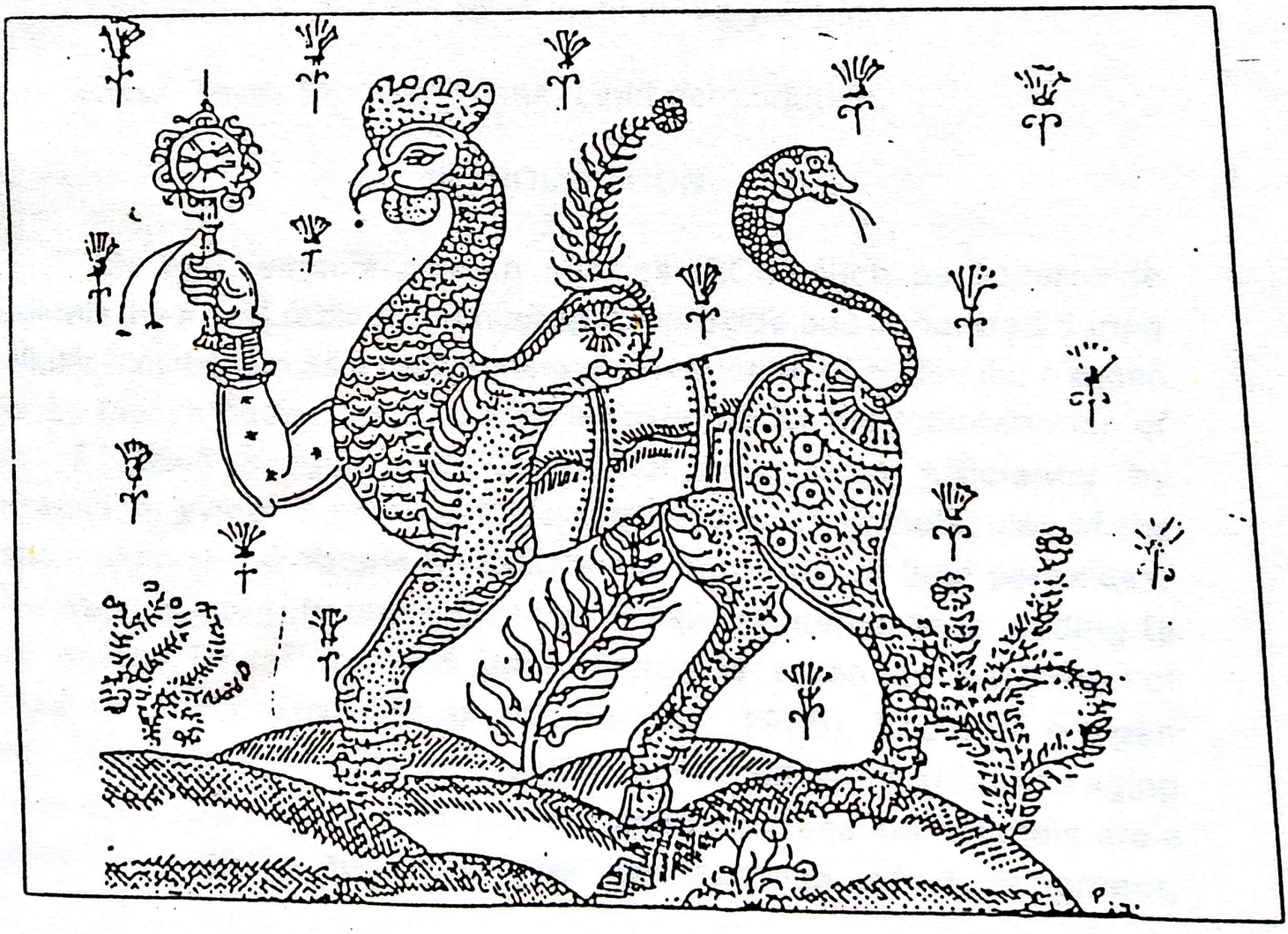
CONTENTS

Emblem of Zoological Society of Orissa

The emblem is of "NABAGUNJARA" a chimeric animal peculiar to Orissan art and literature. Literally meaning "Nineform" it is a common motif in Orissan paintings. This form has been described by poet Sarala Das in his epic Mahabharat written in Oriya. Apparently Lord Krishna appeared in "Nabagunjara" from consisting of the body of an elephant, a leg each of a horse, a deer and a tiger; throat of a peacock, tail in the form of a serpent, waist of the lion, hump of the bull and the head of a cock, to fool his friend Arjuna. The chimera was holding a lotus flower in a human hand. Arjuna has never seen such a creature in his life and guessed that this cannot be a real animal and must be a form assumed by Lord Krishna and bowed down at its feet. It is said that the human hand with the lotus provided the clue. In the paintings and sculptures however, the lotus is often replaced by the "Chakra" or the "stylized discuss" of Lord Krishna.

Chimeric form are encountered in literature and art all over the world. However, a chimera of nine animals, is peculiarly Orissan. Therefore, it is thought that this will be an appropriate emblem for the journal of the Zoological Society of Orissa.



Pranikee. 13-14: 1-4 (1992 & 1993)

SEASONAL VARIATION IN PEROXIDATION LEVEL IN GONADS OF THE COMMON TOAD, *BUFO MELANOSTICTUS*.

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ABSTRACT

Lipid peroxidation (LPX) level was determined in ovary and testis of adult *Bufo melanostictus* in winter, summer and rainy seasons of a year. Results of the present study indicated a seasonal variation in lipid peroxide levels in testis and ovary of the toads. The testis exhibited the highest LPX content during summer while ovary had the peak level in rainy season.

Key words: Toad, Season, Testis, Lipid peroxidation.

INTRODUCTION

Several reactive oxygen species (ROS) such as superoxide radicals, hydroxyl radical and hydrogen peroxide and generated during cellular metabolism as a consequence of reduction of molecular oxygen during biosynthesis of ATP which is essential for the maintenance of life. Reactive oxygen species, if not neutralized efficiently by antioxidant systems of the cell, can attack almost all molecules of the cells including membrane lipids causing formation of lipid peroxides. This impairs integrity and functions of cellular membranes leading to cell death. Therefore, lipid peroxidation is taken as an index of oxidative stress (Halliwell and Gutteridge, 1985). Reactive oxygen species have been implicated in development, differentiation and aging (Harman, 1983 : Allen, 1991). The gonads of seasonal animals are a convenient model to study the phenomenon of development,

differentiation and aging because development and differentiation of gonads of seasonal animals commence with response to particular seasonal stimuli and after achievement of the physiological goal (production of mature gametes) they undergo regression and finally die. Gonads of toads are in a quiescent state during summer and growth and development takes place in rainy season and again undergo regression in winter. In the present study, LPX level in testis and ovary of the common Indian toad (*Bufo melanostictus*) was measured in different seasons to determine if this model manifest similar chemical changes as observed in other models related to development, differentiation and aging.

MATERIALS AND METHODS

Adult male toads were collected locally during various seasons (winter, December to January; Summer. April and May and Rains, July and August) and used in the present study. The gonads were dissected out immediately, cleaned in cold normal saline, pet blotted and weighed to nearest point with the help of an electrical balance, LPX and activities of super oxide dismutase and catalase were estimated as described earlier (Samanta and Chainy, 1997).

RESULTS AND DISCUSSION

The seasonal nature of reproduction in amphibians is well established (Lofts, 1974). Seasonal reproductive profile manifest the complex interaction between exogenous factors such as food availability, temperature and growth and endogenous factors such as hormones. Amphibians are characterized by seasonal changes in many parameters including gonadal development, maturation and regression. Results of the present study (Table.1) exhibited a high LPX value in testis during summer and the value decreased to one fourth during rainy season and again an elevation in its level was recorded during winter. in case of ovary, the minimum LPX level was recorded in

winter which elevated by three folds in summer and by ten folds in the rainy season. Therefore, the results indicated a variation in the rate of production of ROS in gonads with relation to season. Mostly in winter gonads are exhausted and their regression continues till summer. In rainy season the gonads develop and become fully mature and get ready for discharge of gametes during mating. Seasonal variation in lipid peroxidation in testis and ovary may be due to occurrence of qualitative and quantitative changes in lipid profile or due to changes in antioxidant metabolizing enzymes in the gonads with respect to season. Such variations in LPX level in gonads of toad is not surprising because participation of various components of the antioxidant defense system not only varies between species but also between individual organs of same) (Lopez-Torres *et.al.*, 1993; Perez-Campo *et al.*, 1993). Beside, physiological states and external environmental stimuli also play a crucial role in regulating levels of various components of the antioxidant defense system of organs (Buzadzic *et al.*, 1992; Power and Sheehan, 1996). The sequence of changes observed in lipid peroxide profile of testis of toad with relation to seasons indicate that metabolism of reactive oxygen species are closely tied with environmental conditions that may influence the development, differentiation, maturation and regression of gonads in toads.

Table 1: SEASONAL VARIATION IN LIPID PEROXIDATION LEVEL IN THE TESTIS OF *BUFO MELANOSTICTUS*. DATA ARE MEAN + S.D. OF NUMBER OF ANIMALS GIVEN IN THE PARENTHESES. LIPID PEROXIDATION IS EXPRESSED AS NMOL MDA FORMED/MG PROTEIN.

	Winter (5)	Summer (5)	Rainy (5)
Testis	2.91 +0.28	5.49 + 1.02	1.42 +0.10
Ovary	0.68 +0.18	1.93 +0.21	6.11 +0.70

Acknowledgements: We are thankful to the University Grants Commission, New Delhi, for financial assistance and Head, Department of Zoology, Utkal University, Bhubaneswar for extending Laboratory facilities.

REFERENCES

Allen, R.G. 1991. Oxygen-reactive species and antioxidant responses during development the metabolic paradox of cellular identification. *Proc. Soc. Expt. Biol. Med. 196:* 117-129.

Buzadzic, B., Spasic, M.B., Saicic, Z.S., Radojicic, R. and Petrovic, V.M. 1992. Seasonal dependence of the activity of antioxidant defence enzymes in the ground squirrel (*Citellus citellus*). The effect of cold. *Comp. Biochem. Physiol. 101B:* 547-551.

Halliwell, B. and Gutteridge, J.M.C. 1985. *Free Radicals in Biology and Medicine,* Clarendon Press Inc., Oxford

Harman, D. 1983. Free radical theory of aging: Consequences of mitochondrial aging. *Age* 6: 86-94.

Lofts, B. 1974. Reproduction. In *Reproductive Physiology of the Amphibia* Ed. B. Lofts. Academic Press Inc., New York, pp 107-117.

Lopez-Torres, M., Perez-Campo, R., Cadenas, S., Rojas, C. and Barja, G. 1993. A comparative study of free radicals in vertebrates. II. Non-enzymatic antioxidants and oxidative stress. *Comp. Biochem. Physiol.* **105B:** 757-763.

Perez-Campo, R., Lopez-Torres, M., Rojas, C., Cadenas, S. and Braja, G. 1993. A comparative study of free radicals in vertebrates.I. Antioxidant enzymes. *Comp. Biochem. Physiol.* **105B:**749-755.

Power, A. and Sheehan, D. 1996. Seasonal variation in antioxidant defence system of gill and digestive gland of blue mussel, *Mytilus edulis*. *Comp. Biochem. Physiol* **114C:** 99-103.

Samanta, L. and Chainy, G.B.N. 1997. Comparison of hexachlorocyclohexane-induced oxidative stress in the testis of immature and mature rats. *Comp. Biochem. Physiol* **118C:** 317-327.

Pranikee. 13-14: 5-12 (1992 & 1993)

SOME ECOLOGICAL ASPECTS OF BLACKBUCKS (*ANTILOPE CERVICAPRA*) IN BALLIPADAR-BHETANAI WILDLIFE RESERVE, ORISSA

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ABSTRACT

The blackbucks (*Antilope cervicapra*) of Ballipadar-Bhetanai Wildlife Reserve, Orissa frequent cultivated fields of *Oryza sativa, Eleusine coracana, Phaseolus mungo* and grasslands of *Cynodon dactylon, Cyperus rotundus* and *Celosia argentia* etc.. The same habitat is also utilised by the local people as the grazing ground of their domestic animals when there are no standing crops. Drinking of water is irregular. They take rest in open fields for a better vision against predators spending more time on grazing in big herds during early morning and evening. There are six different types of herds among which the harems are the most common type. The territory size remains constant during a particular period. The smallest one is about 1 hectare with a solitary male. Human interference and waterlogging of fields act as major factors for change in territory size. Conservation of the animals is mainly through socio-religious belief of the local people.

Key Words: Antelope, blackbuck

INTRODUCTION

The blackbuck, *Antilope cervicapra* Linn., is one of the most spectacular wild animals of the Indian subcontinent. This beautiful creature is listed as an endangered species in the *Red Data Book*. It was the most abundant ungulate with a total population of some four million until the nineteenth century (Lever 1985) roaming in large herds in the open plains of India (Jerdon, 1874; Lydekker, 1907). The population has greatly declined mainly due to unrestricted killing and habitat degradation. The legal protection under Wildlife (Protection) Act, 1972 has given a boost to increase the population. An all- India estimate puts the number between 29,000 and 38,000 '(Rahmani, 1991)'. They are more abundant in semi-desert tracts with scattered vegetation in Rajastan and Gujarat. Ballipadar-Bhetanai Wildlife Reserve in Orissa harbours a population of blackbucks where socio-religious belief of the local people has served as the principal factor for their conservation. Although several studies have been made on different aspects of blackbucks (Bharucha and Asher 1993; Krishnan 1972; Mungal *et al.* 1981; RamanRao and Prasad 1992), no detailed study has been made on the Orissa herd. This investigation was therefore undertaken to study the behavioural ecology of the antelope species of the herd at Ballipadar-Bhetanai.

STUDY AREA AND METHODS

The Ballipadar-Bhetanai Wildlife Reserve lies in Ghumusar South Division of Ganjam district, between 19°35'-19°55'N and 84°35'—84°50'E covering an area of 72.80 sq km. The area consists of 60-65% cultivated lands, 12-15% rocky elevations, 10-15% settlements and roads, 5-6% forest cover and about 7-8% water bodies. The pH of the acidic soil varies between 5.2 and 7, temperature from 17° to 41°C during the year and an annual rainfall, from 150 to 230 mm.

Collection of data was made on foot during 1994-95 by monitoring line transacts after Burnham *et al.* (1980) with the use of

8x30 binoculars. Usually a gap of 100 meters was maintained between two walking lines. The selection of lines was in a stratified random fashion basing upon the physiography of the study area in different seasons. Regular observations were recorded during day time and also during evening of full moon day. The coat colour, body size, urination posture and horn structure were taken as the bases for age and sex classification. The land structure, dung heaps and movement pattern were regularly marked for identification of territories. People's involvement with blackbucks was studied through frequent enquiries with different age groups.

RESULTS AND DISCUSSION

Pilot surveys were made on two geographically isolated regions of the study area (Fig.1) on 5th & 6th May, 1995 and 26th & 27th June, 1996. The population was 408 and 391 for two consecutive years with almost the same population density 18.28 hectare. The male-female ratio was 0.34 for both the years i.e., 2.2 females per male. Natality varied during the two years' study. However the peak birth period was observed to be March to May. Each time one female gave birth to only one fawn. Natural death was comparatively more in males than females, probably due to horn injury in males. The unnatural deaths were due to illegal capture, taming and transport etc. A total of 45 deaths was recorded during 1995-96 consisting of 13 males, 12 females and 20 fawns (Table 1).

Blackbucks live on fresh tender leaves, grass, crops and sometimes the leaves of shrubs and trees. Generally they select food plants available in the area. During winter, the pulse cultivation was about 30% of the total crops cereals are at their harvesting stage and varieties of grasses abundant. It was observed that blackbucks preferred *Phaseolus mungo* and *Cajanus indicus* and even rested in the moong (*Phaseolus)* fields and nearby places. Grasses like *Cynodon dactylon, Cyperus rotundus* and *Celosia argentia* were their next favourite vegetation. Amongst the three, *C. argentia* is the most preferred one. Bluckbucks prefer only the grains of rice plants and feed upon the entire *ragi* plants (*Eleusine coracana*) during this period.

During the summer months, they browse on the leaves of *Mangifera indica*, *Phoenix sylvestris* and *Tridax procumbens*. Grasses like *C. dactylon* and *C.rotundus* are also preferred during this period. During monsoon, the sprouts of ragi and rice were the most preferred crop plants. Palatability, flavour, tender edible portions of plants and uneven distribution of crops and grasses in different seasons are the probable factors in their feeding preferences. Although *Sesamum indicum* was available in the field it was taken with much hesitation. The blackbucks feed throughout the day. They start feeding in early hours which slows down during the hot hours and thereafter they graze uninterruptedly till dusk. Occasionally, if not adequately fed during daytime, they raid the crop fields during night. This necessiates the farmers to guard their crops during night time also. During the study period, water drinking was rare at midday time which is indicated by the of fresh hoof marks near water holes.

TABLE: 1

Causes of decline of blackbuck population (1995-96) at Ballipadar-Bhetanoi Wildlife Reserve, Ganjam, Orissa.

Causes	No. of Bucks	No. of Does	No. of Fawns
Old age	5	6	-
Dog bite	1	1	1
Infighting (Blood haemorrhage)	3	-	-
Snakebite	1	-	-
Injuries	1	2	-
Over-eating	1	-	-
Pregnancy failure	-	1	-
Illegal capture	-	-	3
Taming and Transport	-	-	15
Flooding	-	-	1
Causes unknown	1	2	-
TOTAL	13	12	20

Usually, during night small groups of blackbucks rested at the centre of the territory and within the open grounds as a safeguard against predators and other dangers. During daytime, the choice of a resting ground is not specific. Females rest within their grazing range and males within the territory. During the hot hours of the day the blackbucks rest under the tree shade. They can also tolerate scorching heat (above 37°C) and continue their feeding activities.

The social organisation of blackbucks is categorised into the following groups:

i) mixed herds formed by males and females of different age groups;
ii) harem herds with one territorial male and females of different ages;
iii) bachelors: all male groups;
iv) all female groups;
v) lone territorial male;
and vi) lone pregnant female.

The harems were noticed most of the time forming 41% of all 248 sightings, and all female groups, the least. The largest herd was a mixed herd with 37 blackbucks and the average herd size was 6. The male-female ratio was 1:8 for harems while 1:6 for mixed herds. Human interference, food preference, social relationship and rutting behaviour are the major factors responsible for changes in social organisation (Panda and Bohidar, 1997).

The blackbucks are territorial. They maintain their integrity within a specific area where the territorial male is the ruler. With the use of dung heaps, urination spots, landforms and location of shrubs and trees it identifies its limitation. The territory is large for larger herds and small for smaller ones. The territorial density is variable with space and time. It was recorded that the territory size of a lone territorial male was the smallest, about 1 hectare.

The socio-religious relationship between man and blackbucks is the dominating factor in their conservation. The old village folk believe that blackbucks' presence increases fertility of the cultivated land and their grazing stimulates plant growth. However, the more densed blackbucks in the core area damage the crops (Chauhan and Singh 1990; Jhala, 1993). Use of the same field by domestic animals for grazing doubles this problem which ultimately affect the sacred relationship between blackbucks and man. Growth in human population, unplanned expansion of roads and houses are the major factors for the decline in the number of blackbucks. The free access of vehicles into the blackbuck habitat and poaching are also not less frequent. The high degree of preference of the blackbucks to *ragi* and pulses during winter causes heavy monetary loss. Therefore the farmers select crops like *S.indicum* and *Lathyrus sativus* of low palatibility to the antelope species in and around their habitat.

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REFERENCES

Bharucha, E. and Asher, K. 1993. Behavioural patterns of blackbucks *Antilope cervicapra* under suboptional habitat conditions. *J. Bombay nat. Hist. Soc.* 90(3): 371-393.

Burnham, K.P., Anderson, D.R. and Laake, J.L.1980. Estimation of density from line transact sampling of biological populations. *Wildlife Monogr.* No. 72. The Wildlife Society, Washington D.C. Pp. 202.

Chauhan, N.P.S. and Singh, R. 1990. Crop damage by over-abundant population of Nilgai and Blackbuck in Haryana (India) and its management. *Proc. 14 Vertebrate Pest Conf.* (Eds. L.R. Davis and R.E. Mash), University of California, Davis: 218-220.

Jerdon, T.C. 1874. *A handbook of the mammals of India.* John Wheldon, London. Pp. 335.

Jhala, Y.V. 1993. Damage to sorghum crop by blackbuck. *Internat J. Pest Management* **39**(1): 23-27.

Krishnan, M. 1972. An ecological survey of the larger mammals of peninsular India. *J. Bombay nat. Hist. Soc.* **68**(3): 503-536.

Lever, C. 1985. *Naturalised mammals of the world.* Longman Group Limited. London and New York. Pp. 487.

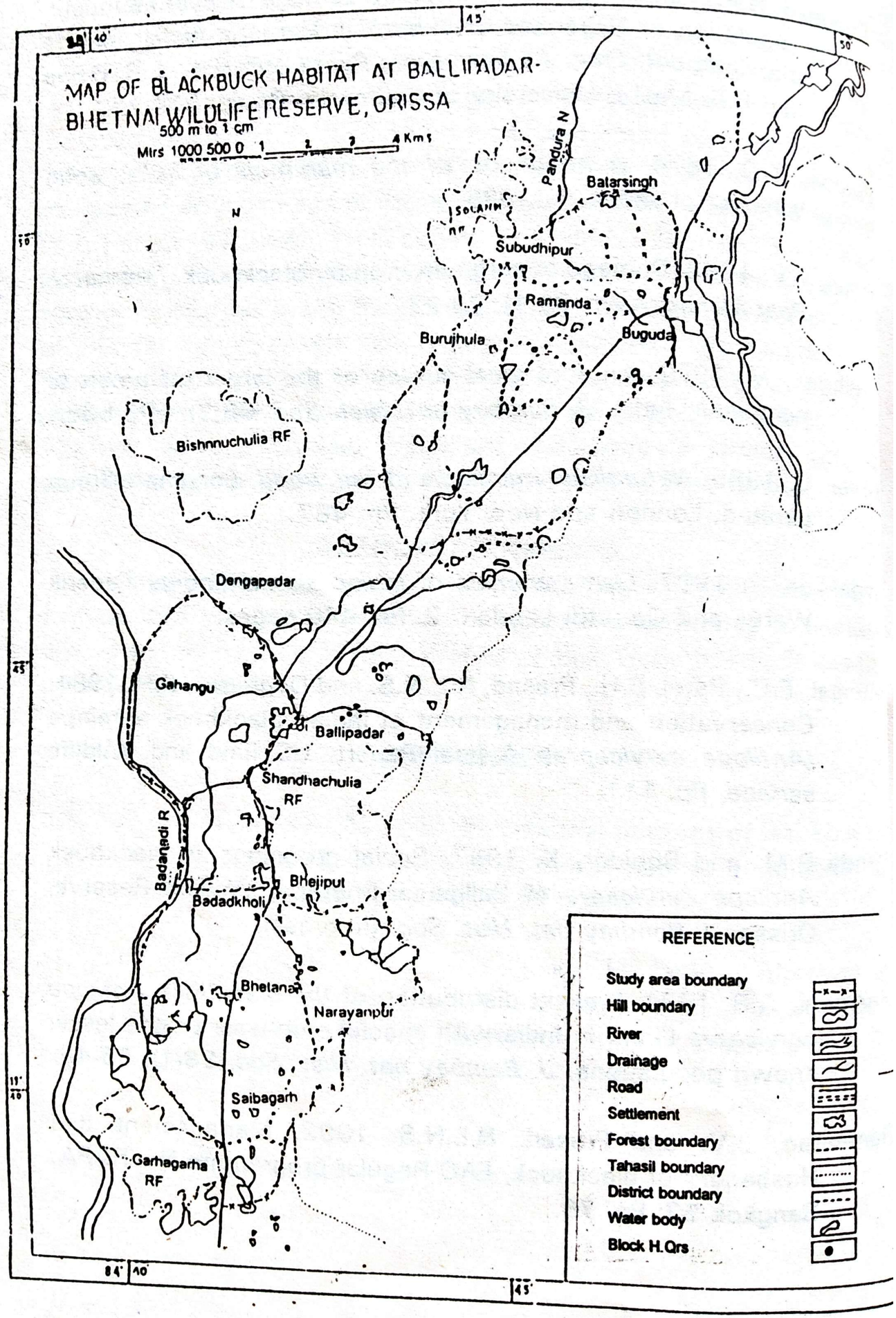
Lydekker, R. 1907. *Game animals of Indian subcontinents* Federik Warue and Co. Ltd. London. **2**. Pp. 440 pages.

Mungal, E.C., Patel, B.H., Prasad, N.L.N.S. and Dogherty, S.H. 1981. Conservation and management of Indian blackbuck antelope (*Antilope cervicapra*): A final Report. US field and Wildlife service, Pp. 111.

Panda R.M. and Bohidar, K. 1997. Social groupings in blackbuck *Antilope cervicapra* of Ballipadar-Bhetanai Wildlife Reserve, Orissa. *J. Bombay nat. Hist. Soc.* (In press).

Rahmani, A.R. 1991. Present distribution of the blackbuck *Antilope cervicapra* Linn., in India with special emphasis on the lesser known populations. *J. Bombay nat. Hist. Soc.* **88**(1): 35-46.

Ramanrao, J.V. and Prasad, N.L.N.S. 1992. Management and Husbandry of blackbuck, FAO Regular programme No. RAPA. Bangkok **53**: Pp. 76.


MAP OF BLACKBUCK HABITAT AT BALLIPADAR-
BHETNAI WILDLIFE RESERVE, ORISSA
500 m to 1 cm
Mtrs 1000 500 0 1 2 3 4 Kms
N
Pandua N
Batarsingh
Subudhipur
Ramanda
Buguda
Burujhula
Bishnnuchulia RF
Dengapadar
Gahangu
Ballipadar
Shandhachulia RF
Badanadi R
Bhejiput
Badadkholi
Bhetanai
Narayanpur
Saibagarh
Garhagarha RF
REFERENCE
Study area boundary
Hill boundary
River
Drainage
Road
Settlement
Forest boundary
Tahasil boundary
District boundary
Water body
Block H.Qrs

Pranikee. 13-14: 13-17 (1992 & 1993)

EXTENT OF RICE STEM BORER EGG PARASITIZATION AND LARVAL/MOTH PREDATION BY ITS NATURAL ENEMIES

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ABSTRACT

In deep water rice ecosystem of coastal Orissa, stem borer (*Scirpophagus incertulus*) egg masses were found parasitized by *Telenomous dignoides, Tetrastichus schoenobii* and *Trichogramma japonicum* between the 3rd week of September and 3rd week of November. Amongst them *T. dignoides* was the predominant species and was responsible for 18.38, 42.71 and 24.76% parasitization during September, October and November respectively (average of 1994 and '95). The other two parasites made their appearance in November and caused 3.32 and 0.07% parasitization. Five species of spiders namely *Lycosa pseudoannulata, Argiope catenulata, Araneus inustus, Atypena formosana* and *Tetragnatha maxillosa* were found feeding on stem borer moths of which the wolf spider, *L. pseudoannulata* on an average consumed 4 moths/day while the others at 0.36 to 2.0 moths/day. The lady bird beetle, *Micraspis* sp. and the carabid beetle, *Ophionea nigrofasciata* consumed @ 0.54 and 5.72 first instar larvae/day respectively, but the lady bird beetle was more abundant.

Key words: *Lycosa*, Paddy, Stem borer, *Scirpophaga*, *Telenomous*, wolf spider.

INTRODUCTION

Once the eggs of the stem borer are deposited in the crop, the factors that will reduce their population most, are the natural enemies comprising parasites, predators and pathogens. Therefore, conservation of natural enemies is important for successful management of rice stem borers. The most vulnerable stages are the eggs and the larvae. Although more than a hundred stem borer species have been identified (Khan *et al.*, 1991), most are recorded from the larval stage but the extent of parasitization is very low. The egg parasites on the other hand are more important and they often achieve about 90% control. The three most important egg parasites found under Bhubaneswar, Orissa condition are *Telenomus dignoides*, *Tetrastichus schoenobii* and *Trichogramma japonicum*. In order to study their potentiality under deep water situation, observations on the extent of egg parasitization by these three species were recorded in addition to the feeding potentiality of five species of commonly available spiders on stem borer moth and predatory beetles on neonate stem borer larvae.

MATERIALS AND METHODS

Egg masses of Yellow stem borer, *Scirpophaga incertulus* were collected from deep water rice fields during the period of brood emergence (Sept.-Nov.) and kept separately in glass vials plugged with cotton swabs. The parasite/ yellow stem borer (YSB) larvae that hatched out from the egg masses were separated out 15 days after larval/parasite emergence and counted species-wise. To separate out individual eggs, the egg masses were treated in 2% KOH solution. The number of eggs in an egg mass and the number of larvae/parasites that hatched out were counted separately and are presented in Table 1.

In order to determine the feeding efficacy of spiders on YSB moths and predatory beetles (Lady bird beetle and Carabid beetle) on neonate larvae, potted rice plants were covered with mylar cages and individual specimens of spiders/beetles were released separately into

the cages provided with the required prey. The feeding efficiency was recorded at 24 hours intervals and this procedure was continued for about two weeks. Varying number of prey were provided to determine the maximum feeding capacity of individual species of predators.

RESULTS AND DISCUSSION

The YSB eggs were parasitized by *T. dignoides, T. schoenobii* and *T. japonicum* in the *kharif* season of 1993 and 1994. The extent of parasitization was 18.94 to 51.76 and 17.83 to 49.15% during 1993 and 1994 respectively. Amongst them *T. dignoides* was the dominant species and was responsible for 11.99-50.45% parasitization during different weeks. Maximum egg parasitization by the species 50.45%, was recorded in the second week of October and minimum 11.99% in the third week of November, 1994. *T. schoenobii* made its appearance in the first week of November and was responsible for 1.15-6.85% egg parasitization and less than 1% of eggs were attacked by *T. japonicum*. From the study it is evident that on an average 34.28-50.45% YSB eggs were parasitized during October under Deep Water Rice ecosystem (Table 1). Working on the extent of egg parasitization Samalo (1983) reported 2.87-54.91% parasitization by the above three species of parasites.

The wolf spider, *Lycosa pseudoannulata* was the most prominent predator and consumed on an average 4 moths/day. The orb spider *Atypina formosana* consumed 1.82-2.0 moths/day while the long jawed spider. *Tetragratha mexillosa* 0.36 moths/day. The lady bird beetle *Micraspis* sp. consumed @ 0.54 neonate larvae/day whereas the carabid beetle, *Opheonea nigrofasciata* ate 5.72 newly hatched larvae/day (Table 2). However,the lady bird beetles were more abundant compared to the carabid beetle.

Table 1. Extent of Egg parasitization of Yellow stem bore *Scirpophaga insertulas* (mean of 1993 and 1994).

Month/ Week	Mean egg Parasitization % by			Total
	Telenomus dignoides	*Tetrastichus schoenobii*	*Trichogramma japonicum*	
Sept. I	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
II	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
III	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
IV	18.38 (17.83-18.94)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	18.38 (17.83-18.94)
Oct. I	44.17 (41.92-46.43)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	44.17 (41.92-46.43)
II	50.45 (49.15-51.76)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	50.45 (49.15-51.76)
III	41.95 (41.75-42.15)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	41.95 (41.75-42.15)
IV	34.28 (32.25-36.32)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	34.28 (32.25-36.32)
Nov. I	29.20 (28.08-30.33)	1.95 (1.61-2.30)	0.0 (0.0-0.0)	30.81 (30.38-31.94)
II	33.08 (31.61-34.55)	1.15 (0.0-2.31)	0.11 (0.0-0.23)	34.34 (33.92-34.38)
III	11.99 (11.08-12.91)	6.85 (5.63-8.08)	0.11 (0.0-0.23)	18.95 (18.54-19.39)
IV	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)

Figures in parentheses indicate the extent of parasitization ranges during 1993 and 1994.

Table 2. Feeding potentiality of arthropod predators of rice stem borer *Scirpophaga incertulas* (Oct.-Nov., 1994)

Sl. No.	Name of predator	Predators released (No)	Hosts* supplied (No.)	Hosts* consumed in 24 hrs. (No.)	Consumption rate per day (No.)	Host stage supplied
1.	Wolf spider *Lycosa pseudoannulata*	10	41	40	4.00	Moth
2.	Orb spider *Argiope catenulata*	11	30	21	1.90	Moth
3.	Orb spider *Araneus inustus*	9	27	16	1.80	Moth
4.	Dwarf spider *Atypena formosana*	10	25	20	2.00	Moth
5.	Long jawed spider *Tetragnatha maxillosa*	11	15	4	0.36	Moth
6.	Lady bird beetle *Micraspis sp.*	24	95	13	0.54	I instar larvae
7.	Carabid beetle *Ophionea nigrofasciata*	11	82	63	5.72	I instar larvae

* Mean of 10 observations.

REFERENCES

Khan, Z.R., Litsinger, J.A., Barrion, A.T., Villanueva, F.F.D, Fernandez, N.N.J. and Taylow, L.D (1991). World Bibliography of Rice stem borers (1974-1990) IRRI, Philippines, Pp. 1-415.

Samalo, A.P. (1983) Studies on the integrated control of paddy stem borers and gall midge. Ph.D. Thesis, Orissa University of Agriculture and Technology, Bhubaneswar, India, Pp. 1-207.

Pranikee. 13-14: 19-25 (1992 & 1993)

OXYGEN CONSUMPTION BY KIDNEY HOMOGENATES IN THE MALES OF *CALOTES VERSICOLOUR* (DAUDIN)

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ABSTRACT

The endogenous respiration of kidney homogenate was significantly lower than the respiration with added substrates (succinate). Oxidation of ascorbic acid was found to be only marginal. Sodium malonate inhibited the respiratory rate of kidney homogenates with succinic or ascorbic acid as substrates but not significantly when both the substrates were present.

Key word : Garden lizard, Respiration, Substrate.

INTRODUCTION

Studies on respiratory metabolism of tropical reptiles are limited. The Oxygen consumption of *Calotes nemoricola* (Jerdon) was found to increase with rise in temperature upto 40°c (Subba Rao and Rajabai, 1974). That the metabolic rate of male garden lizards is age dependent has been reported (Rao and Patnaik, 1973). The respiratory metabolism of skeletal muscle of garden lizard was shown to be sensitive to cadmium (Rao and Patnaik, 1977). Age dependency of tissue respiration in garden lizard has been observed. Both endogenous respiration and the respiration with added substrates have been shown to decline with age in brain (Das and Patnaik, 1979 a, b) and liver (Kara and Patnaik, 1980). The absence of seasonal effect and

temperature dependency in the Oxygen consumption of brain were the other characteristic features (Das and Patnaik, 1978). That the pyruvate oxidation by midbrain of the garden lizard is sex dependent and is sensitive to cold exposure have been shown (Das and Patnaik, 1979 a). Ascorbic acid synthesising ability of kidney has been ascertained (Padhi, 1980). It is therefore, thought worthwhile to assess the rate of its Oxidation in the kidney. In addition, the metabolism of kidney was studied on the basis of endogenous respiration and with added substrates.

MATERIAL AND METHODS

The lizards weighing between 32-48g. and a snout to vent length range 9.3-11.6 Cm, collected during June-September, 1978 were used for experimentation. Each lizard was killed by a blow on the head, the kidney was immediately transferred to ice-cold ringer (pH 7.4) and the adherent materials were cleaned. The sample was quickly weighed and homogenized at a medium speed for two minutes in scientronic, Porter and Elvehjem type of homogeniser with teflon pestle. Oxygen uptake of kidney homogenates at 33°C was measured manometrically in a Warburg respirometer (Ultra make, Calcutta) using Ringer (g./litre : 6.5 NaCl, 0.140 KCl, 0.120 $CaCl_2$, 0.100 $NaHCO_3$) pH 7.4, as the medium. The substrates used were either ascorbic acid (25mM) or sodium succinate (25 mM). The endogenous respiration was also studied without any exogenously added substrates. The inhibition of respiratory rate with ascorbic acid or succinate as substrates was studied using sodium malonate as the inhibitor.

The Protein from measured volume of hemogenate was precipitated with 10% TCA, dissolved in 3% NaOH and the content estimated following the biuret method (OSER, 1965). Colorimetric readings were taken in ERMA (Japan model AE II) Colorimeter. Egg albumen (BDH) was used as the standard.

RESULTS

On the basis of all the three parameters (g.wet wt.,g.protein and per organ) the respiratory rate of kidney homogenates without any exogenously added substrate was significantly lower than the rates with succinate and ascorbic acid as substrates (Tables Ia, Ib, Ic).

Between the substrates succinate was found to yield a higher rate of respiration than the ascorbic acid. When these two substrates were mixed in equal proportions as expected, an intermediate value of Oxygen consumption was obtained (Table Ia).

Sodium malonate significantly inhibited the respiratory rate of kidney homogenates with succinate or ascorbic acid as substrates. But the degree of inhibition was not significant when the two substrates, succinic acid and ascorbic acid were mixed in equal proportions.

Table 1(a): OXYGEN CONSUMPTION BY KIDNEY HOMOGENATES OF MALE GARDEN LIZARD AT 33°C

Condition	ml.O_2/g.protein/ hr. Average ± SEM (No. of animals)	µl.O_2/whole tissue/hr Average ± SEM (No. of animals)	µl./O_2/g/tissue/hr. Average + SEM - (No. of animals)
Without substrate	0.67±0.12 (5)	31.00±3.91	121.12±12.36 (5)
Succinic acid.	2.11±0.88 (5)	82.64±24.85 (5)	312.90±82.05 (5)
Ascorbic acid.	0.91±0.14 (5)	37.40±6.39 (5)	161.49±37.08 (5)
Succinic acid + Ascorbic acid	1.52±0.27 (5)	67.22±11.15 (5)	247.65±30.53 (5)
Succinic acid + Ascorbic acid + Sodium malonate	1.16±0.19 (5)	61.84±16.57 (5)	232.15±46.80 (5)
Succinic acid + Sodium malonate.	0.88±0.19 (5)	62.38±16.11 (5)	176.48±31.98 (5)
Ascorbic acid + Sodium malonate	0.22±0.05 (4)	17.38±4.99 (4)	63.07±12.62 (4)

TABLE 1(b): OXYGEN CONSUMPTION BY KIDNEY HOMOGENATES OF MALE GARDEN LIZARD AT 33°C (NUMBER OF ANIMALS USED FIVE)

Condition	$ml.O_2$/g.protein/hr . Average±SEM	'p'	μlO_2/whole tissue/hr. Average ± SEM	'p'	μlO_2/g. tissue/hr. Average ±SEM	'p'
Without substrate	0.67±0.12		31.00±3.91		121.12±12.36	
Succinic acid (25 mM)	2.11±0.88	NS	82.64±24.85	<0.1	312.90±85.05	<0.1
Ascorbic acid	0.91±0.14	NS	37.40±6.39	NS	161.49±37.08	NS

TABLE 1(c): OXYGEN CONSUMPTION BY KIDNEY HOMOGENATES OF MALE GARDEN LIZARD AT 33°C

Condition	$ml.O_2$/g Protein/hr average value ±SEM (No. of animals)	'p'	$\mu l.O_2$/whole tissue/hr Average value ± SEM (No. of animals)	'p'	$\mu l.O_2$/g. tissue/hr Average value ±SEM (No. of animals)	'p'
Succinic acid	2.11±0.88 (5)	NS	82.64±24.85 (5)	NS	312.90±85.05 (5)	NS
Succinic acid + Sodium malonate	0.88±0.19 (5)		62.38±16.11 (5)		176.48±31.98 (5)	
% Change	58.29		24.51		43.60	
Ascorbic acid (AA)	0.91±0.14 (5)	<0.01	37.40±6.39 (5)	<0.1	161.49±37.08 (5)	<.1
Ascorbic acid + Sodium malonate	0.28±0.05 (4)		17.38±4.99 (4)		63.07±12.62 (4)	
% Change	69.23		53.53		60.94	
Succinic Acid +AA	1.52±0.27 (5)	NS	67.22±11.15 (5)	NS	247.65±30.53 (5)	NS
Succinic acid + AA + Sodium malonate	1.16±0.19 (5)		61.84±16.57 (5)		232.15±46.80 (5)	
% Change	23.68		8.00		6.26	

Per organ basis except for ascorbic acid as substrate, the respiratory inhibition was not significant in other cases (Table Ic).

The average protein contents of kidney were found to be 183.97 ± 5.93 mg/g. wet weight basis and 49.04 ± 2.53 mg/whole-kidney.

DISCUSSION

The endogenous respiratory rate of kidney homogenates of garden lizard is significantly lower than the rate of liver and brain homogenates suggesting the limitation of endogenous substrates. Similarly, the respiratory rate with succinate as substrate was significantly lower in kidney homogenates than in the kidney seems to have the lowest rate of metabolism.

Even though mega doses of ascorbic acid is known to augment renal respiration in Guinea-pigs (Poryadin, 1977), the ascorbic acid Oxidation by kidney homogenates of male garden lizard seems to be very much limited. A comparison of the values between the endogenous respiration and the respiration with ascorbic acid as substrates reveals only a marginal difference between them. This is in contrast to the situation in mammalian kidney cortex where a considerable amount of ascorbic acid is Oxidised (Shukla and Kanungo, 1968). But since in liver, the synthesising organ in rat, the Oxidation of ascorbic acid is lower than that of kidney, it is likely that the lower rate of Oxidation in the kidney, the synthesising organ of garden lizard is not unusual but a device to channelize ascorbic acid for purposes other than its participation in Oxidation/ reduction reactions. It thus seems probable that Oxidation of ascorbic acid in kidney may play a minor role in general metabolism of garden lizards. Whether the same is true for other reptiles needs further investigation.

Sodium malonate, a competitive inhibitor of succinic dehydrogenase (SDH) inhibits the Oxidation of both succinate and

ascorbic acid separately. But when both the substrates were present the rate of inhibition was negligible suggesting the protective action of ascorbic acid.

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REFERENCES

Das, K. and Patnaik, B.K. (1978). Respiratory metabolism in the garden lizard, (*Calotes versicolor)* brain : Oxygen consumption with endogenous and exogenous substrates and effect of temperature and season. *Indian J. Exp. Biol.*, **16** :1010-1011.

Das, K. and Patnaik, B.K. (1979a). Effect of age, sex and cold exposure on pyruvate Oxidation of mid-brain of the garden lizard, *Calotes versicolor*. Indian *J.Exp. Biol., 17*: 1371-1373.

Das, K. and Patnaik, B.K. (1979b). Effect of short term cold stress on the respiratory metabolism of brain tissue homogenate of male garden lizards of two different age groups. *Gerontology*, 25: 9-15.

Kara, T.C. and Patnaik, B.K. (1980). Age-related changes in the Oxygen consumption and the SDH activity of liver homogenate of male garden lizards. Effect of malonate and short-term cold stress, *Gerontology,* **26** : 247-253.

Oser, B. (1965). In *Hawks Physiological Chemistry*. Blackistone Division, McGraw Hill Company, Newyork. Pp. 694-1250.

Padhi, S.N. (1980). Some aspects of ascorbic acid metabolism in the kidney of male garden lizard. Ph.D. thesis, Berhampur University, Orissa.

Poryadin, V.B. (1977). Effect of massive dose of ascorbic acid on tissue respiration, *Vopr. Pitan.*, **2** : 46-49.

Rao, K.L, and Patnaik, B.K. (1973). Correlation between body weight and S-V length, tail-girth and metabolic rate in the male garden lizard, *Calotes versicolor.* Exp. *Geront.*, **8** : 173-176.

Rao, R.K. and Patnaik, B.K. (1977). Cadmium chloride inhibition of respiratory metabolism in skeletal muscle of the garden lizard, *Calotes versicolor* (Daudin). *Indian J.Exp. biol.*, **15** : 147-148.

Shukla, S.P. and Kanungo, M.S. (1968). Oxidation of ascorbic acid by the liver and kidney cortex of rate of various ages. *Exp. Geront.*, **3** : 243-245.

Subba Rao, M.V. and Rajabai, B.S. (1974). Influence of thermal acclimation of Oxygen consumption in the agamid garden lizard, *Calotes nemoricola* (Jerdon) with special reference to size, sex, temperature season and climatic conditions. *Proc. Indian Acad. Sci.*, **79** : 1-15.

Pranikee. 13-14: 27-34 (1992 & 1993)

THE LEAF BEETLES (CHRYSOMELIDAE, COLEOPTERA, INSECTA)

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ABSTRACT

The principal families of chrysomelid beetles, e.g., Hispinae, Criocerinae, Cassidinae, Galerucinae, Halticinae and Eumolpinae attacking agricultural crops in India are listed.

Key words: Cassidinae, Chrysomelidae, Criocerinae, Eumolpinae, Galerucinae, Halticinae, Hispinae, leaf beetles.

INTRODUCTION

Some 1,135,000 species of insects have been described (Eastop,1977). They far outnumber all other animals in variety and number. It is estimated that insects are so prolific and numerous that for each human being there are about 300 million insects (Schneiderman, 1972). Insects are grouped under 29 distinct divisions or orders of which Coleoptera is one. Some 300,000 beetles have been described under this order. They are distinguished by the hardened anterior pair of wings termed the elytra, under which lie the posterior pair of membranous wings in folded condition, to be stretched and spread for use during flight. The order Coleoptera has been subdivided into 170 families (Crowson, 1955). The largest families of Coleoptera that walk up and down the leaves, stems and fruits of plants, and feed on them, are the Curculionidae (weevil), Chrysomelidae (leaf beetles) and the Cerambycidae (longicorn or longhorned beetles). All these beetles have four-segmented tarsi. The

third tarsal segment is usually bilobed and provided with large hair-pods underneath. The fourth tarsal segment is severely reduced, the undersurface of which bears pads made of hair. Chrysomelidae forms one of the five largest families under Coleoptera (Table 1). The beetles of this family are mostly oval in shape and are generally distinguished by their metallic colouration of the general surface of the body and moderate length of the antenna which is neither very long nor very short, usually less than half as long as the body.

Table 1. FIVE LARGEST FAMILIES UNDER ORDER COLEOPTERA WITH ESTIMATED NUMBER OF SPECIES DESCRIBED.

1.	Curculionidae	50, 000
2.	Staphylinidae	28,000
3.	Chrysomelidae	25,000
4.	Carabidae	20,000
5.	Cerambycidae	20,000

The Chrysomelid beetles feed on the softer parts of plants, by cutting large holes on the margin of leaves, as in the poplar beetle, *Melasoma populi*, and by making large holes all over the leaves, as in the tortoise beetles (Cassinae). The larvae of chrysomelid beetles, however, graze in 'herds' on the undersurface of the leaves and skeletonize them.

Under the family Chrysomelidae, there are a good number of subfamilies such as, Cassidinae, Hispinae, Camptosomatinae, Donaciinae, Halticinae, Synetinae (Sagrinae), Orsodacninae, Criocerinae, Chrysomelinae, Galerucinae and Eumolpinae, which are notorious pests of agriculture. Brief notes about some of the major subfamilies harbouring species of economic importance in India are given below.

Table 2. HOST-PLANTS OF "SPINY BEETLES" (HISPINAE) OF ECONOMIC IMPORTANCE IN INDIA.

	Name of species	Host-plant
1.	*Agonita fuscipes* Baly	Screwpine
2.	*Asmangulia cuspidata* Maulik	Sugarcane, paddy
3.	*Botrynope sanguinea* Guerin	Coconut palm
4.	*Callispa minima* Gestro	Coconut
5.	*Dicladispa armigera* (Olivier) (= *Hispa armigera* Ol) (= *Hispa aenescens* Baly)	Rice, maize
6.	*Dicladispa damma* Chapuis	Apple
7.	*Estigmena chinensis* Hope	Bamboo
8.	*Hispa stygia* Chapuis	Apple, rice, sorghum, maize
9.	*Leptispa pygmaea* Baly	Rice, potato, sugarcane, grasses
10.	*Oncocephala dorsalis* Weise	Sweet potato
11.	*Oncocephala tuberculata* Oliver	Sweet potato
12.	*Phidodonta modesta* Weise	Sugarcane, grasses, rice, sorghum, maize
13.	*Platypria andrewesi* Weise	Sugarcane, ber
14.	*Platypria hystrix* Fabricius	Red gram, dadap, country bean, chestnut
15.	*Rhadinosa lebongenesis* Maulik	Paddy, sugarcane
16.	*Wallacena dactyliferae* Maulik	Date-palm.

HISPINAE

The beetles of this group are known as wedge-shaped or leaf-mining leaf beetles. They are small, elongate, 4 to 7 mm in length and are very spiny. The adults spend much of their time on the spiny fruits and seed-pods of the host-plant, and it is believed, the spines of the body of these beetles have evolved as camouflage. The "spiny beetles" are of great economic importance as they devastate crops. They are distributed over an extensive area from the sub-arctic to the tropical regions. Some 2800 species placed under 100 genera and 23 tribes have been described. Some 178 species occur in India (Maulik, 1919). The crops and plants attacked by different species in India (Maulik, 1919; Nair, 1975; Nayar *et al.*, 1976) are listed in Table 2.

CRIOCERINAE

This group includes *Lema* which widely occurs as pests of agricultural importance (Palaniswami & Pillai, 1984; Nair,1975; Sengupta & Behura, 1956, 1957a, 1957b). Species of importance in India are set in Table 3.

TABLE 3. Important *Lema* (Criocerinae) pests of India.

	Name of species	Host-plants
1.	*Lema downsei* (Baly) (Syn. *Aulema downsei*)	Ragi
2.	*L. laecordaeirei* Baly	Edible yam
3.	*L. praeusta* (Fabricius)	Cucurbits, turmeric
4.	*L. semiregularis* Jac.	Cucurbits, turmeric
5.	*L. signatipennis* Jac.	Cucurbits, turmeric
6.	*Lema* sp.	Cardamom

CASSIDINAE

This group includes the curiously-shaped tortoise beetles, 5 to 6 mm in length, whose lateral margins of the body are greatly expanded giving the insects a flattened shieldlike appearance. Their flat spiny larvae cover themselves with their cast skins and excreta. Onehundredfifty two species under 16 genera have been reported from India by Maulik (1919). The beetles which have been recorded as pests on crops in India (Maulik, 1919; Nair, 1975) are given in Table 4.

TABLE 4. Tortoise beetles (Cassidinae) recorded as pests in India.

	Name of beetle	Host-plant
1.	*Aspidomorpha miliaris* (Fabricius)	Sweet potato (*Ipomoea* sp.)
2.	*Cassida circumdata* Herbst =(*Cassida sexnotata* Herbst)	Do
3.	*Cassida exilis* Boheman	Amaranthus
4.	*Cassida indicola* Duv	Sweet potato
5.	*Chirida promiscua* (Boheman) (= *Metriona circumdata* Spaeth)	Do
6.	*Oocassida obscura* Fabricius	*Zizyphus* sp.
7.	*Silana farinosa* Boheman	*Murraya koenigi*

GALERUCINAE

Members of Galerucinae are known as cucumber beetles. These are soft-bodied insects measuring 2.5 to 11 mm in length. The general colouration of the elytra is yellowish with dark spots or stripes. The larvae live in the soil feeding on the roots and underground stems of cucurbitaceous plants. Some species are highly injurious to the host-

plants. The major species recorded as pests in India are set in Table 5. The pumpkin beetles (*Aulacophora*) are sometimes seen feeding on various pulse crops (Nair, 1975).

TABLE 5: Cucumber beetles (Galerucinae) recorded as major pests in India.

	Name of beetle species	Host-plants
1.	*Aulacophora atripennis* F.	*Cucurbita maxima* (pumpkin) *C. pepo* (pumpkin) *Cucumis melo* *C. sativus* *Citrullus lanatus* *C. vulgaris* (tinda) *Luffa acutangula* *L. cylindrica* (Sponge gourd) *Trichosantus anguina*
2.	*Aulacophora lewisi* Baly (= *Aulacophora intermedia* Jacoby)	Cucurbitaceous plants
3.	*Aulacophora stevensi* B	Cucurbitaceaus plants
4.	*Galerucella birmanica* (Jacoby)	*Trapa bispinosa* (Singhara)
5.	*G. placida* Baly	Polygonaceous (*Polygonum* spp.) medicinal plants (in Jammu and Kashmir).
6.	*Raphidopalpa foveicollis* (Lucas) (= *Aulacophora foveicollis*)	All the host plants of *Aulacophora atripennis* *Benincasa hispida* (Ash gourd). *Lagenaria vulgaris.*

HALTICINAE (Alticinae)

These active beetles known as "flea beetles" have great leaping powers which reside in the swollen hind femora. The colouration is black, blue, greenish or brownish. Some possess line markings on the elytra. The larvae of some feed openly on the parenchyma of the leaves while others live in the soil feeding on the roots of the plants, the adults eating the leaves. The major species recorded as pests in India (Maulik, 1926; Nair, 1975). are listed in Table 6.

TABLE 6: Flea beetles Haltictinae (= Alticinae) recorded as major pests in India.

	Name of beetle species	Host-plant
1.	*Altica cyanea* (Weber) (= *Haltica cyanea* Weber)	Singhara (*Trapa bispinosa*)
2.	*Chaetocnema pusaensis* Maulik	Millets (*Panicum miliaceum*)
3.	*Haltica caerulescens* Baly	Cabbage
4.	*Longitarsus belgaumensis* Jacoby	Sunnhemp (*Crotolaria juncea*)
5.	*L. nigripennis* Motschulsky	Pepper (*Piper nigrum*)
6.	*Phyllotreta cruciferae* Goeze	Cruciferous vegetables
7.	*Phyllotreta downesi* Baly	Cruciferous vegetables.

EUMOLPINAE (Eumolpine leaf beetles)

The beetles are usually oblong and convex, metallic or yellowish with spots, prothorax narrower than elytra. The reddish-brown, metallic, with six black spots, grapevine beetle *Scelodonta strigicollis* Mots., is a well-known pest of grapevine (*Vitis vinifera*).

REFERENCES

Crowson, R.A. (1955). *The natural classification of the families of Coloptera*. Nathaniel Lloyd & Co., London, Pp. 187.

Eastop, V.P. (1977). In *Worldwide importance of Aphids as Virus Vectors*. (Eds. Harris, K.F. and Maramorosch, K.), Academic Press: 3-62.

Maulik, S. (1919). *The Fauna of British India including Ceylon and Burma. Coleoptera. Chrysomelidae (Hispinae and Cassidinae)*. Taylor and Fransis, London. Pp. 439 +xi.

Maulik, S. (1926). *The Fauna of British India including Ceylon and Burma. Coleoptera Chrysomelidae (Chrysomelinae and Halticinae)*. Taylor and Francis, London. Pp. 442 + xiv.

Nair, M.R.G.K. (1975). *Insects and mites of crops in India*. Indian Coun. of Agric. Res., New Delhi. Pp 404 + viii.

Nayar, K.K., Ananthakrishnan, T.N. and David, B.V. (1976). *General and Applied Entomology*. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi: 328-362. (Coleoptera).

* Palaniswami, M.S. and Pillai, K.S. (1984). *Pseualsomyia* sp. a new parasite of *Lema laecordaeirei* B. *Entomon*. **9**(1): 75 *Entomology Abs*. **17**(2);77 (Abs. No. 1399) 1986)].

Schneiderman, H.A. (1972). Insect hormones and insect control. In *Insect juvenile hormones, Chemistry and action*. (Eds. Menn, J.J. and Beroza, M.). Academic Press, New York, London. Pp. 341 + xv.

Sengupta, G.C. and Behura, B.K. (1956). On the life-history of *Lema semiregularis* Jac. (Coleoptera, Chrysomeloidea, Crioceridae). *J. Bombay nat. Hist. Soc*. **53**: 484-485.

Sengupta, G.C. and Behura, B.K. (1957a). On the biology of *Lema praeusta* Fab. *J. econ. Ent*. **50(4)**: 471-474.

Sengupta, G.C., and Behura, B.K. (1957b). Annotated list of crop pests in the State of Orissa. *Entom. Soc. India*. Memoir 5 Pp. 44.

(* Not consulted in Original)

Pranikee. 13-14: 35-38 (1992 & 1993)

GLUTATHIONE S-TRANSFERASE ACTIVITY IN LIVER AND BRAIN OF DEVELOPING CHICKS

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ABSTRACT

Glutathione S-transferase activity in brain and liver of 3, 14, 21 and 28 day old chicks were measured. In all age groups, liver had always higher glutathione S-transferase activity than brain. With age the level of the enzyme increased in liver but decreased in brain.

Key words: Chick, Development, Glutathione S-transferase

INTRODUCTION

Conjugation of many electrophilic substances such as mutagens and carcinogens with glutathione serves an important detoxification mechanism which is catalyzed by the enzyme glutathione S-transferase (GST, EC 2.5.1.18) (Jackoby, 1978; Chasseaud, 1979). Although there are many reports on perinatal development of glutathione-S-transferase activity in hepatic and extra hepatic tissues of different animals (Hales and Neims, 1976; Das *et al.*, 1981, Fujita *et al.*, 1985; Gregus *et al.*, 1985), a comprehensive comparative account of development pattern of the enzyme in different tissues of birds in general and chicks in particular is not available. In the present study glutathione S-transferase activity in brain and liver of male chick is compared during early phase of development.

MATERIALS AND METHODS

One-day-old White Leg horn Chicks were obtained from local Government Central Poultry Farm and maintained in the laboratory as described earlier (Samanta & Chainy, 1997). They were fed with commercial chick food and water was supplied *ad libitum*. Cerebral cortex and liver were dissected out from 3-Day-, 14-Day-, 21-Day- and 28-Day-old chicks immediately, washed thoroughly in ice-cold normal physiological saline and homogenized (10%, w/v) in 100 mM ice cold phosphate buffer, pH 6.5 with the help of a motor driven homogenizer fitted with teflon pestle with 10 up and down strokes. The crude homogenate was centrifuged at 12000 x g for 30 min at 4°C to obtain post-mitcohondrial supernatant. The enzyme activity was measured in the supernatant according to the method; Habig *et al.* (1974) using CDNB as substrate. The enzyme activity was expressed as n moles of GSH conjugated /mg protein / minute. Protein content of the supernatant was estimated according to the method of Lowry *et al.* (1951).

RESULTS AND DISCUSSION

In the present study two important observations were noted with regard to cytoplasmic GST activity in tissues of chick during postnatal development. Firstly, GST activity in the liver is higher than that of the brain. Secondly, the age related distribution of GST activity between brain and liver during early stages of development is distinctively different. In case of brain, GST activity was higher on Day 3 of the age but gradually decreased as age advanced and was about two-third value of Day 3 on Day 21 and remained more or less same on Day 28. On the other hand, the enzyme activity in the liver increased gradually with age and was about 2 fold higher on Day 28 in comparision to Day 3 of age (Fig. 1).

Das *et al.* (1981) studied GST activity in different regions of brain of birds with respect to age. Our observation is in good agreement with the results of Del Bocci *et al.* (1987). These authors

noticed high GST activity in cytosol fractions of liver of adult *Bufo bufo* in comparison to brain. Similarly, it is reported that adult rat liver has five times higher GST activity than that of 2-day-old pups (Hales and Neim, 1976). Since liver is the main tissue which is responsible for detoxifying xenobiotics, it is not surprising to observe higher GST activity in this tissue in comparison with brain. It will be of interest to know the isoenzyme patterns of GST in brain and liver during postnatal development of chick. Another interesting observation made during this study is that the enzyme activity in the cytoplasmic fraction of tissue homogenate (liver) was fairly stable even after storage for 168 hr at -15°C (O, h 60.32 + 4.67; 168h, 50.44 + 4.97).

REFERENCES

Chasseaud, L.F. (1979) The role of glutathione and glutathione S-transferases in the metabolism of chemical carcinogens and other electrophilic agents. *Adv. Cancer Res.* 20: 175-293.

Das, M., Dixit, R., Seth, P. and Mukhtar, H. (1981) Glutathione S-transferase activity in the brain: species, sex, regional and age differences. *J. Neurochem.* 36: 1439-1442.

Del Boccio, G., Ilio, C. Di., Miranda, M., Manilla, A., Zarivi, O., Bonifigli, A. and Federic, G. (1987) Glutathione transferase activity during *Bufo bufo* development. Comp. Biochem. Physio. 86: 749-753.

Fujita, S., Kitagawa, H., Ishizawa, H., Suzuki, T. and Kitani, K. (1985) Age-associated alterations in hepatic glutathione S-transferase activities. *Biochem. Pharmacol.* 34: 3891-3894.

Gregus, Z., Varga, F. and Schmelas, A. (1985) Age-development and inducibility of hepatic glutathione S-transferase activities in mice, rats, rabbits and guinea-pigs. Comp. Biochem. Physiol. 80C: 85-90.

Habig, W.H., Pabst, M.J. and Jakoby, W.B. (1974) Glutathione S-transeferase. The first step in mercapturic acid formation. *J. Biol. Chem*. 249: 7130-7139.

Hales, B.F. and Neims, A.H. (1976) Developmental aspects of glutathione S-transferase B (ligandin) in rat liver. *Biochem. J.* 160: 231-236.

Lakoby, W.B. (1978). The glutathione S. Transferase: a group of multifunctional detoxicant proteins. *Adv. Enzymal.* 46: 383-414.

Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randallo, R.J. (1951). Protein measurement with Folin phenol reagent. *J. Biol. Chem.* 193: 265-275.

Samant, L. and Chainy, G.B.N. (1997). Age-related differences of hexachlorcyclohexane effect on hepatic oxidative stress parameters of chicks. *Ind. J. Expt. Biol.* 35: 457-461.

Pranikee. 13-14: 39-46 (1992 & 1993)

UTILIZATION OF HABITAT BY MIGRATORY SHOREBIRDS (ORDER : CHARADRIIFORMES) WINTERING IN CHILIKA LAKE, ORISSA

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ABSTRACT

Chilika, the largest brackish water lake in India, in the east coast of Orissa provides an ideal feeding and roosting ground for millions of waterfowl belonging to 58 migratory,6 local migratory and 29 resident species. Of the total 47 species of shorebirds visiting the lake, 39 species are migratory and the rest are local migratory species. The Nalaban island (15.53 sq km) in the central sector of the lake alone hosts over 75% of the total population. The island was declared as a 'Wildlife Sanctuary' in 1987. The status distribution and habitat utilization of shorebirds were studied during September 1993 through May 1996. Among the habitat types identified, mud flats are the most preferred habitat used both for feeding and roosting. The shorebird habitat in the lake is fast shrinking due to intensive encroachment for aquaculture and several other related factors.

Key Words: Charadriiformes, Chilika Lake, Shorebird.

INTRODUCTION

The Chilika lake, an internationally important 'Ramsar Site' (notified under Ramsar Convention, 1971) and a 'Closed area' under Forest Shooting Rules in 1973 is the largest brackish water lagoon in India. The lake has legendary importance because of its scenic beauty

and as an unique wetland which sustains a rich biodiversity including 93 species of aquatic birds. Order Charadriiformes consisting of shorebirds only embraces 47 species forming about 0.04 million of the total population of birds visiting the lake during the peak period in winter (Acharya and Kar, 1996). Fragmentary observations have made on the general aspects of waterfowls of the lake by Dev (1986), Kar (1990) and Mohapatra and Hussain (1988). The present study was undertaken to determine the preferred habitat of migratory shorebirds, their status, distribution and the various anthropogenic factors responsible for the degradation of their habitat in the lake area.

STUDY AREA

The Chilika lake is situated between latitude 19°28' N to19°54'N and longitude 85°6'E to 85°35'E, and extends over Puri, Khurda and Ganjam districts. It covers an expanse of 1165 sq km (maximum) in the rainy season (Annandale and Kemp, 1915) and 790 sq km (minimum) in Summer (Anonymous, 1989). The pear-shaped lake runs parallel to the coast and is connected with the Bay of Bengal at its Northern end by a 29 km long and 365 m wide irregular channel. The lake mouth where it opens into the sea and locally known as 'Magaramukha', is situated 6 km from Arakhakuda village (Map 1). The lake has several islands. The most potential island 'Nalaban' (15.53 sq km) alone hosts over 75% of the total bird population of the lake.

The unique feature of the lake is its salinity which is maintained by the influx of sea water through the lake mouth and freshwater from rivers Daya, Bhargavi, Nuna, Kusumi and Ratnachira etc., and the local streams around the lake discharging their water into the lagoon Fluctuation in the salinity of water plays a vital role in maintaining the rich biodiversity of the lake.

METHODS

Observations were recorded during September 1993 to May 1996 every fortnight. The lake habitat can be divided into three major sub-habitats which can be further subdivided into eight microhabitats. This categorisation was formulated basing on the bill structure and tarsus length of shorebirds, and moisture-content of the microhabitats (Table 1). Identification of different flocks of migratory shorebirds visiting different microhabitats was done by direct visual observation with a 8 x 50 binocular from 0600 hours to 1800 hours during the day. For each flock or individual bird of a species located, the following information was recorded: i) the exact location; ii) number of birds in a flock; iii) the habitat types utilised and iv) the activity of the flock e.g., feeding, roosting, preening, movement etc. The utilisation of microhabitat was calculated by the ratio of number of sightings of a particular species in a microhabitat to the total number of sightings.

RESULTS AND DISCUSSION

The study indicated that mud flat (MIH-D) is the most preferred microhabitat for both feeding and roosting. Grassland (MIH-G) and Sandridge (MIH-E) are the other preferred microhabitats (Table 2). However, it varies with different families of Charadriiformes. Jacanidae preferred marshland (MIH-C); plovers shanks (Charadriidae) mud flats; stints and small sandpipers (Charadriidae) Sand ridge); Recurvirostridae and Glareolidae mud flats Laridae, shallow water (20-150 cm) and deep water (>150 cm) for feeding and other activities. Only snipes (Charadriidae) utilised the scripus bushes (MIH-H) (Table 2).

The occurrence of shore bird species is restricted to habitat preferences. In other words, shorebirds utilise those habitats which they prefer. Thus their presence in a habitat indicates their preference for that habitat and absence indicates avoidance.

In many countries threats to shorebird habitat such as mud flat, intertidal estuaries or freshwater marshes and lakes have increased

manyfold during the twentieth century. During this period, wetlands have generally been poorly assessed and used to serve when human needs as agricultural or urban land. The Chilika lake is slowly dying due to various factors such as shrinkage of area, narrowing of the opening into the sea, siltation, growth of weeds, over exploitation of fishes, prawns and crabs, brackish water prawn culture, pollution of water, loss of salinity.

REFERENCES

Acharya, Smita and S.K. Kar 1996. The Checklist of waders (Charadriiformes) in Chilika lake, Orissa. *Newsletter for Bird watchers* **36** (5): 89-90.

Annandale, N. and S. Kemp. 1915. Introduction to the fauna of Chilka lake. *Mem. Indian Mus.* **5** (1): 1-20.

Anonymous, 1989. *Annual Report 1988-89*, Orissa Govt., Bhubaneswar, pp. 32.

Dev, U.N. 1986. *The checklist of Birds of Chilika lake*, Orissa.

Dev, U.N. 1988. Project Bihanga-A project under Easternghats Ecodevelopments. Technical Report Submitted to Department of Environment, Govt. of India, New Delhi. Pp.71.

Kar, S.K. 1990. Chilika: Birds' paradise. *Orissa Review* **16** (9): 26-28.

Mohapatra, K.K. and S.A. Hussain 1988. The pride of our Wetland heritage. *A state of art report*, Orissa Environmental Society Bhubaneswr.

Mohapatra, K.K. and S.A. Husain, 1988. Avifauna of Chilka lake. In: S.N Patro Editor Chilka-The pride of our wetland heritage, Orissa Environmental Society, Pp.89-95

TABLE 1: CATEGORISATION OF BIRD HABITATS IN CHILIKA LAKE, ORISSA

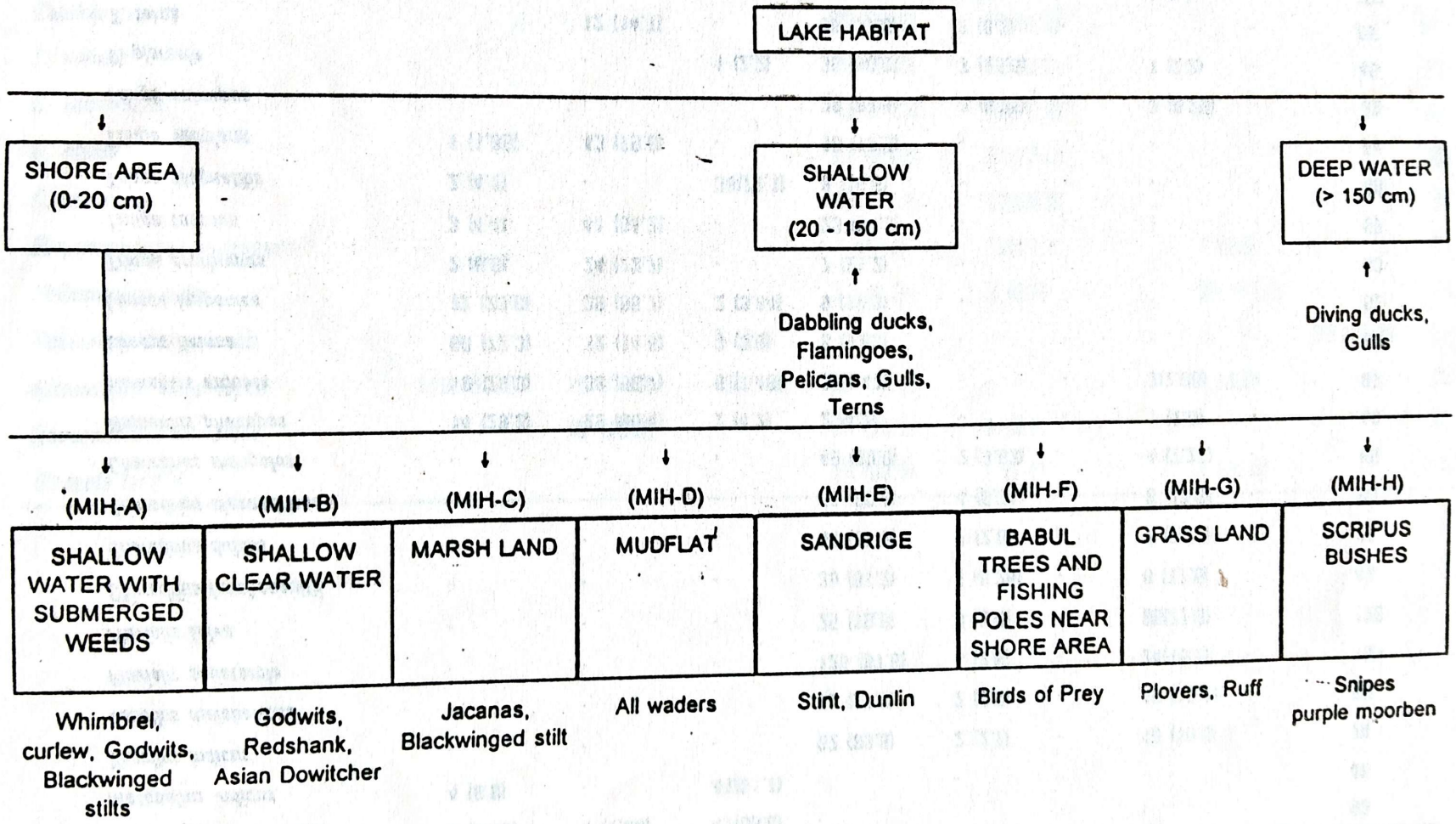
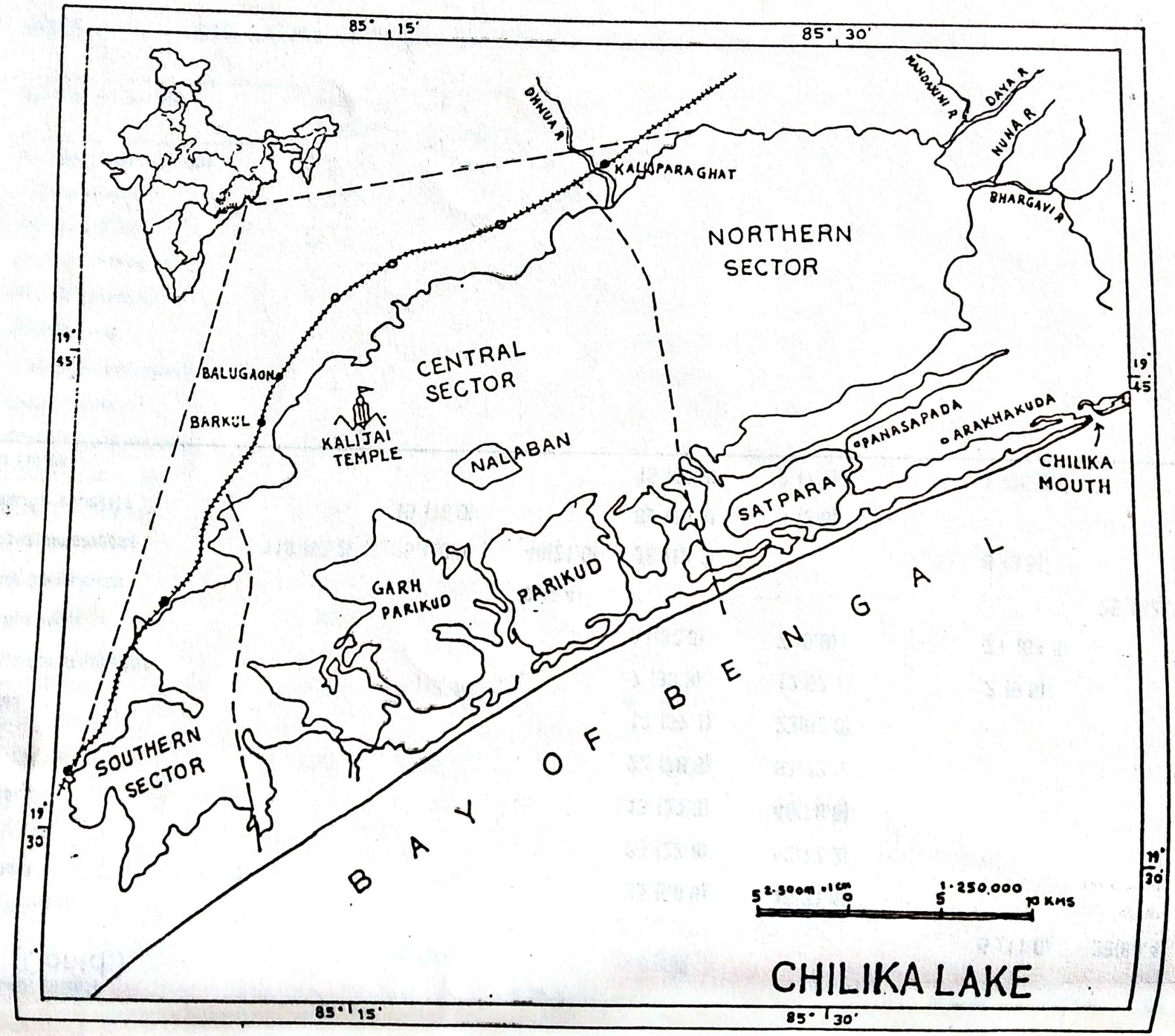


TABLE 2: UTILISATION OF MICROHABITATS BY SHOREBIRDS IN CHILIKA LAKE, ORISSA

Name of the species	MIH-A No. (%)	MIH-B No. (%)	MIH-C No. (%)	MIH-D No. (%)	MIH-E No. (%)	MIH-F No.(%)	MIH-G No. (%)	MIH-H No. (%)	Total sightings
Hydrophasianus chirurgus	5 (9.43)	1 (1.88)	47(88.6)	.	.	.	.	.	53
Metopidius indicus	4 (8.9)	.	41(91.1)	.	.	.	.	.	45
Vanellus indicus	.	.	.	62 (83.8)	2 (2.7)	.	10 (13.5)	.	74
Vanellus malabaricus	.	.	.	53 (77.9)	2 (2.9)	.	13 (19.1)	.	68
Pluvialis squatarola	.	.	.	125 (81.6)	4 (2.6)	.	24(15.7)	.	153
Pluvialis fulva	.	.	.	25 (19.8)	3 (2.4)	.	98(77.8)	.	126
Charadrius leschenaultii	.	.	.	39 (81.2)	3 (6.25)	.	6 (12.5)	.	48
Charadrius dubius	.	.	.	63 (87.5)	2 (2.8)	.	7 (9.72)	.	72
Charadrius alexandrinus	.	.	.	51 (80.9)	4 (6.34)	.	8 (12.6)	.	63
Charadrius mongolus	.	.	.	49 (89.0)	2 (3.63)	.	4 (7.27)	.	55
Numenius phaeopus	14 (29.2)	29 (60.4)	2 (4.2)	2 (4.2)	.	.	1 (2.0)	.	48
Numenius arquata	19 (28.3)	38 (56.7)	5 (7.46)	3 (4.47)	.	.	2(2.98)	.	67
Limosa limosa	60 (72.3)	12 (14.5)	3 (3.6)	8 (9.63)	.	.	.	.	83
Limosa lapponica	12 (23.0)	29 (55.7)	2 (3.84)	9 (17.3)	.	.	.	.	52
Tringa erythropus	2 (6.0)	24 (72.7)	.	7 (21.2)	.	.	.	.	33
Tringa totanus	3 (4.4)	41 (61.2)	.	23 (34.3)	.	.	.	.	67
Tringa stagnatilis	2 (4.2)	.	38(79.1)	8 (16.6)	.	.	.	.	48
Tringa nebularia	1 (1.85)	43 (79.6)	.	10 (18.5)	.	.	.	.	54
Tringa ochropus	.	.	.	28 (87.5)	2 (6.25)	.	2 (6.25)	.	32
T. glareola	.	.	1 (2.2)	36 (80.0)	7 (15.5)	.	1 (2.2)	.	45
T. terek	.	12 (14.1)	.	66 (77.6)	7 (8.2)	.	.	.	85
T. hypoleucos	.	.	.	84 (82.4)	12(11.8)	.	6 (5.9)	.	102
Limnodromus semipalmatus	7 (10.4)	38 (56.7)	.	22 (32.8)	.	.	.	.	67
Gallinago stenura	.	.	1 (3.1)	.	.	.	3 (9.4)	28(87.5)	32

Table 2 (Contd.)

G. gallinago	.	.	.	.	.	.	5 (11.6)	38(88.4)	43
Calidris canuta	.	.	.	35 (68.6)	16(31.4)	.	.	.	51
C. minuta	.	.	.	20 (27.8)	52(72.2)	.	.	.	72
C. temminckii	.	.	.	13 (21.3)	48(78.6)	.	.	.	61
C. alpina	.	.	.	22 (26.5)	61(73.5)	.	.	.	83
C. testacea	.	.	.	13 (37.1)	22(62.8)	.	.	.	35
Eurynorhynchus pygmaeus	.	.	.	7 (33.3)	12(57.1)	.	2 (9.5)	.	21
Philomachus niger	.	.	.	11(32.3)	2 (5.9)	.	21 (61.8)	.	34
Rostratula bengalensis	.	.	2 (7.4)	.	.	.	.	25 (92.6)	27
Himantopus himantopus	119 (52.2)	25 (10.9)	48(21.0)	28 (12.3)	.	.	8 (3.5)	.	228
Recurvirostra avosetta	.	15 (18.0)	.	65 (78.3)	3 (3.6)	.	.	.	83
Glareola lactea	.	.	.	19 (67.9)	2 (7.1)	.	7 (25.0)	.	28


85° 15'
85° 30'
DHNUA R
KAUDAJHNI R
DAYA R
NUNA R
BHARGAVI R
KALUPARA GHAT
NORTHERN SECTOR
19° 45'
BALUGAON
BARKUL
CENTRAL SECTOR
KALIJAI TEMPLE
NALABAN
PANASAPADA
ARAKHAKUDA
CHILIKA MOUTH
SATPARA
GARH PARIKUD
PARIKUD
SOUTHERN SECTOR
19° 30'
B A Y O F B E N G A L
2·500m = 1cm
1:250,000
10 KMS
CHILIKA LAKE
85° 15'
85° 30'

Pranikee. 13-14: 47-57 (1992 & 1993)

ANNUAL OVARIAN CYCLE AND HISTOCHEMISTRY OF VITELLOGENESIS IN THE FRESH WATER TELEOST, *PUNTIUS SOPHORE*

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ABSTRACT

A study of ovarian histology and histochemistry of oocytes of *Puntius sophore* has been made. The mean Gono somatic index (GSI) and Ova diameter are recorded every month over one year to determine the monthly ovarian activity and annual ovarian cycle. Moreover, attempts have been made to trace the origin and chemical composition of eggs by conducting various histochemical tests for Proteins, Carbohydrates, Lipids, and Nucleic acids. The yolk is found to be rich in lecithin, cephalin, saturated fatty acids, histidine, tyrosine, arginine and acid mucopolysaccharides.

Key Words: *Puntius,* Ovarian Cycle, Histochemistry vitellogenesis, yolk

INTRODUCTION

Histology and annual ovarian cycle including role of nucleoli, yolk nucleolus and ooplasmic organelles have been studied in greater detail by many workers. Early histochemical studies of vitellogenesis emphasised only on distribution of polysaccharides (Aketa 1954, Yamamoto, 1958). However later workers shifted their emphasis from carbohydrate to the lipid composition of oocytes and to the origin of

yolk (Yamamoto 1958, Nayar 1964). Malone Hisaoka (1963), Guraya (1976), Piska and Prasadam (1991), Sarasquete *et al.* (1993), Munoz-Cueto *et al.* (1996), Anderson 1967 have attempted to make an in-depth study of the polysaccharides, proteins and lipids and their distribution in teleost oocytes. The present paper deals with the annual ovarian cycle and histochemistry of vitellogenesis in the oocytes of *Puntius sophore*.

MATERIALS AND METHODS

Immediately after collection of the fishes, the ovaries were dissected out. The weight of the ovary and the weight of the fish samples were taken to find out the GSI of the fish every month. The Ovaries were fixed in Bouin's fluid, Carnoy's fluid, 10% neutral formalin and formol calcium. As usual, paraffin sections were used for histological and histochemical preparation for the study of proteins, carbohydrates and nucleic acids, while formol calcium fixed frozen sections were used for the study of lipids. To study the chemical composition of the Yolk, the vitellogenic oocytes were subjected to various histochemical tests as described by Pearse (1975), Gurr (1962).

RESULTS

OVARIAN MORPHOLOGY:

The ovaries of the *P. sophore* are paired elongated organs lying ventral to the kidney and are connected to the body wall by means of mesovarium. The ovaries are found to be thin and thread like during immature stage but are found to be flattened and lobulated when matured, covering most part of the body cavity. Histologically the ovaries are covered with a peritoneal membrane composed of outer squamous epithelium, intermediate tunica albugenia and inner germinal

epithelium. The matrix of the ovary has a number of folds, the ovigerous lamellae containing germ cells projecting into the lumen of the ovary.

Based on various histological changes of the ovary on its way to maturity the following stages of the oocytes are distinguished.

STAGE I: The oocyte has a large nucleus and thin cytoplasm. The average oocyte diameter is 65 μm. The nucleoli get arranged along the periphery of the nuclear membrane. The yolk nucleus moves to the periphery of the ooplasm.

STAGE II: The oocyte measure 200-360 μm in diameter. Vacuoles appear in the ooplasm. Nuclear membrane becomes irregular in outline and the nucleoli get scattered in the ooplasm.

STATE III: The Yolk globules appear in the cytoplasm. Follicular layer increases in thickness by addition of another layer of cuboidal cells. The nuclear membrane is distorted and the nucleoli lie scattered inside nucleus.

STAGE IV: The yolk globules increase in quantity in the periphery and slowly invade the interior of the ooplasm. Nuclei get reduced in size. Nucleus becomes highly irregular in shape. The maximum diameter of the oocyte at this state is 400 μm.

STAGE V: Oocytes of this stage attain an average diameter of 560 μm. The size of the nucleoli become smaller and get into the ooplasm as a result of break down and disintegration of nuclear membrane.

ATRESIA: Soon after the spawning of the species which extends from May to November, atretic oocytes are seen in large numbers. All the five, different stages of oocytes undergo atresia either due to autolysis or secretions released by hyperactive follicular cells.

ANNUAL OVARIAN CYCLE

The ovary undergoes annual cyclical changes which are found to consist of the following stages.

1. Resting phase: This phase covers the month of December and January. The ovary looks transparent and consists of exclusively immature oocytes.
2. Preparatory phase: This phase covers February to April. The process of vitellogenesis proceeds during this phase. The ovary contains 50% immature and 50% maturing and mature oocytes.
3. Prespawning phase: This phase covers the entire month of May. The ovaries get enlarged and become distended. The ovaries cover the entire space of the body cavity. During this phase the ovary contains 70% of fully matured eggs.
4. Spawning phase: Majority of *P. sophore* spawn during the month of June and July. The ovaries attain maximum size. The mature and ripe ova decrease in number due to spawning, whereas immature oocytes increase in number gradually.
5. Post Spawning phase: This phase lasts from August to December. The spent and the unspent ovaries undergo a process of regression and are reduced in size. The number of stage I oocytes (immature oocytes) gradually increase, so much so that they count 90% of the total oocytes in the month of November.

G.S.I. AND OVA DIAMETER

The gonosomatic index of each fish sample is calculated by the formula:

$$\frac{\text{Mean ovarian weight}}{\text{Mean Body weight}} \times 100$$

The mean ova diameter of the fish is measured every month from January to December. When the mean ova diameter and mean GSI are plotted against their corresponding months, a clear relation between GSI and ova diameters and a definite relation between ovarian activity and both are obtained. GSI and ova diameter can be established. From the graph it is clear that the ovarian activity is at it's peak in May and the value of GSI and ova diameters attain their maximum value during May after which they gradually decline.

Table I: Showing monthly variation in mean GSI and ova diameter

Month	Average wt. of the fish in gms	Average wt. of the ovary in gms	Mean GSI ± S.D.	Average ova diameter in μm
January	8.377	0.259	3.1±0.54	65±9.35
Frebuary	6.808	0.313	4.6±0.59	130±7.00
March	7.633	0.142	5.4±0.41	200±14.58
April	7.655	0.497	6.5±0.54	360±7.90
May	8.887	1.225	13.8±0.36	560±14.14
June	6.705	0.583	8.7±0.52	500±18.71
July	7.473	0.553	7.4±0.47	410±7.07
August	8.401	0.588	7.0±0.61	330±18.71
September	8.176	0.547	6.7±0.60	290±13.69
October	8.100	0.469	5.8±0.59	260±14.14
November	7.440	0.334	4.5±0.43	124±12.75
December	7.281	0.276	3.8±0.54	80±6.12

HISTOCHEMISTRY OF VITELLOGENESIS

In *P. sophore* two types of yolk, namely carbohydrate yolk and compound yolk develop during vitellogenesis.

The Carbohydrate yolk:

The Carbohydrate yolk is histochemically detected to be of two types. One is strongly PAS positive while the other is moderately PAS positive. Further testing of the carbohydrate yolk with salivary amylase and malt diastase confirmed the presence of glycogen in the strongly PAS positive yolk and absence in moderately PAS positively yolk. Both types of carbohydrate yolk are found to have non sulphated acid mucopolysaccharides.

The Compound yolk:

This type of yolk contains protein and lipid. Test with Mercury Bromophenol Blue and Ninhydrin-Schiff's reagent gave positive indication of protein bound NH_2 groups. Further more the presence of histidine, tyrosine and arginine is detected.

The lipoidal nature of the compound yolk bodies is confirmed after their staining reaction with ethanolic and propylene glycolic SBB followed by extraction with a mixture of Chloroform and methanol. Further extraction with acetone, ether and pyridine ascertains the presence of sudanophilic phospholipids like lecithin, cephalin. Acid haematin, Pyridine and Nile Blue stain confirmed the phospholipid contents. In addition, presence of saturated fatty acid is detected in the compound yolk bodies after treating with Fischler's reagent.

DISCUSSION

A study of available literature reveals conflicting views on the source of origin of oocytes in freshwater teleosts. Many other workers have reported that germinal epithelium in the ovigerous lamellae is the principal source of production of new crop of oocytes. This has been observed in *P. sophore*. Adequate attention has not been given to distinguish various stages of fish oocytes. However, the aspect of staging has received some attention (Guraya, 1976). On the basis of histochemical studies *P. sophore* shows five distinct stages.

In the fish under study extra nucleoli have been observed originating from chromatin particles as has been reported by Rita Kumari and Padmanabhan (1976). In this fish, nuclear extrusions has apparently no role in vitellogenesis. This is in agreement with the workers Verma *et al.* (1983). In *P. sophore*, yolk granuels are synthesised at the cost of ooplasmic materials. Endogenous vitellogenesis has been observed with suspected involvement of cytoplasmic organelles as reported by Droller and Roth (1956).

Histochemical analysis of the yolk in vitellogenic oocytes revealed that the yolk of *P. sophore* is constituted of carbohydrates consisting of glycogen and acid mucopolysaccharides. The compound yolk is made up of protein and lipid. The protein fraction contains aminoacids like arginine, histidine, tyrosin and NH_2 bound proteins. Lipid fraction consists of saturated fatty acids and phospholipids like lecithin and cephalin.

REFERENCES

Aketa, K. 1954. The chemical nature and origin of cortical alveoli in the eggs of the Medaka, *Oryzias latipes*. *Embryologie* 2: 63-66.

Anderson, E. 1967. Formation of primary envelope during the oocyte differentiation in teleosts. *J. Cell. Biol.* 35: 193-212.

Droller, M.J. and Röth, T.P. 1956. An electron microscope study of yolk formation during oogenesis in guppy, *Lebistes reticulatus*. *J. Cell. Biol.* 28: 209-232.

Guraya, S.S. 1976. Recent advances in morphology, histochemistry, Biochemistry of steroid synthesizing cellular sites in the non mammalian vertebrate ovary. *Int. Rev. Cytol.* 44: 365-409.

Gurr, E. 1962. Staining animal tissue, practical and theoretical. Leonard Hill Books, London.

Malone, T.E. and Hisaoka, K.K. 1963. A histochemical study of the formation of deutoplasmic components in developing oocytes of Zebra fish. *Brachidanio rerio. J. Morph.* 112: 61-75.

Munoz Cueto, J.A.; Alvarez, M.; Gonzalez De Canales, M.L.; Garcia Garcia, A.; Sarasquete, C. 1996. Histochemical and biochemical study of lipids during reproductive cycle of the toad fish, *Halobatrachus didactylus. Sci. Mar. Barc.* 60 (2-3): 289-269.

Nayar, R.P. 1964. The yolk nucleus of fish oocytes. *Qurt. Jour. Micros. Sci.* 105: 153-158.

Pearse, A.G.E. 1975. *Histochemistry theoretical and applied.* Vol.1. Churchill Livingstone Ltd. London.

Piska, R.S. and Prasadam, M.R. 1991. Seasonal variations in the biochemical composition of reproductive tissues in relation to breeding cycle of the carp minnow, *Salmostoma bacaila* (Ham.) from Himayathsagar, Hyderabad. *Comp. Physiol. Ecol.* 16(2): 69-71.

Ritakumari, S.D. and Padmanabhan, K.G. 1976. Oogenesis in the pearlspot. *Etropeus sweatensis. Zool. Anz*: 133-143.

Sarasquete, M.C.; Munoz Cueto, J.A.; Gonzalez de Canales, M.L.; Garcia Garcia, A.; Rodriguez, R.B. 1993. Histological, histochemical and immunohistochemical characteristics during oogenesis of *Solea senegalensis* in the Gulf of Cadiz (Spain). *4th Natl. Congr. on Aquaculture, Vilanova de Arousa, Galicia (Spain)*: 21-24.

Verma, G.P.; Sahu, K.C. and Acharya, V.R. 1983. Vitellogenesis in a teleost *Channa punctatus. Comp. Physiol. Ecol.* 8: 82-86.

Yamamoto, K. 1958. Vitellogenesis in the first eggs. *Symposia cellular Chem.* 8: 119-134.

FIGURE LEGEND

Puntius sophore

Fig 1. Stage I oocyte with yolk nucleus (YN) in the peripheral ooplasm. TB x 900.

Fig 2. Stage III oocyte exhibiting zonation of the ooplasm inner zone (IZ) and outer zone (OZ). Haematoxylin/Eosin x 900.

Fig 3. Showing stage I oocyte (arrow) and atretic oocyte (AO). Hg BPB x 900.

Fig 4. Stage II oocytes with vacuoles (arrow) in the peripheral zone. TB x 900.

Fig 5. Showing atretic stage V oocytes with dissolving yolk globules (YGL) in the peripheral ooplasm. SBB x 900.

Fig 6. Stage V oocytes filled with yolk globules (YGL) Hg BPB x 900.

Fig 7. Stage V oocytes with cortical alveoli (CA) in the peripheral ooplasm. Note the negative reaction in the yolk globules (YGL). PAS x 900.

Fig 8 Showing atretic stage III oocytes (AO) with vacuolated ooplasm. Haematoxylin/Eosin x 900.

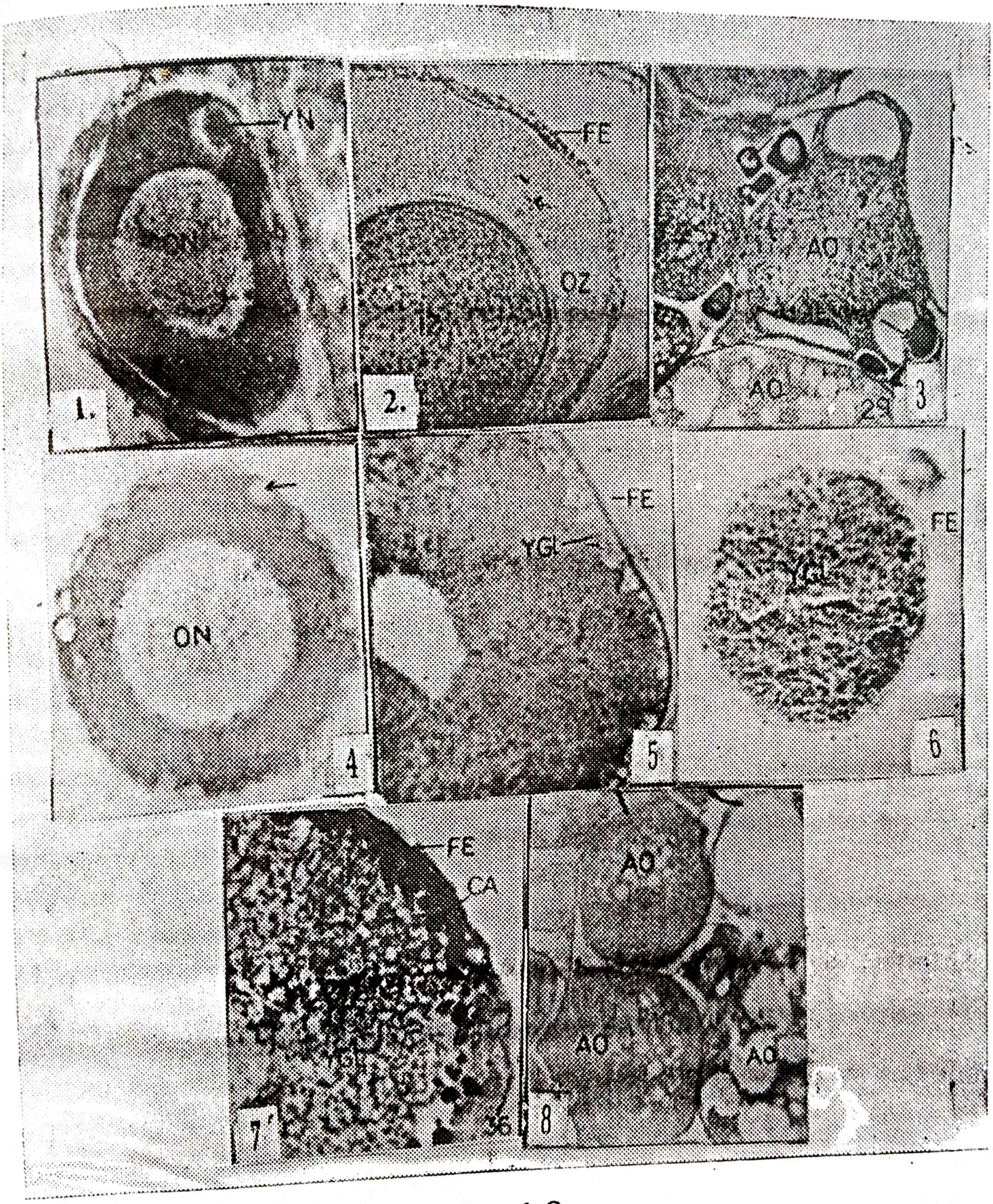

Fig. 1-8

(Oocytes of *Puntius sophore* in various stages of development.)

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ON POPULATION STUDIES OF *EPILACHNA DODECASTIGMA* WIED (COCCINELLIDAE : COLEOPTERA)

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ABSTRACT

Population studies of *Epilachna dodecastigma* Wied., infesting *Luffa acutangula* Roxb., were undertaken in three different experimental plots situated equidistantly one km apart at Cuttack, Orissa, during 1977-79. Weekly observations showed first infestation on 19th June, 1977 and 18th June, 1978 in all the three experimental plots. Infestation lasted upto 18 December, 1977 and 24 December, 1978. Population showed four peaks during each season and was at lowest ebb during October and December.

Key Words: Population, infestation, *Luffa acutangula*

INTRODUCTION

Epilachna dodecastigma Wied., is a serious pest of Cucurbitaceae. Its pest activities in Orissa have been recorded by Sengupta and Behura (1957). Sexual dimorphism in the beetle species was studied by Behura *et al.* (1975). The present paper deals with population studies of *E. dodecastigma* on its host-plant, ribbed gourd (*Luffa acutangula*), a valuable cash crop in Orissa.

MATERIALS AND METHODS

Three different plots, each covering an are of about 12.45 sqm were chosen in the outskirts of the city of Cuttack, Orissa and were marked as F_1, F_2 and F_3. Each plot was situated at a distance of about one kilometer from each other. The plots were ploughed thoroughly and well irrigated with water from the nearby Taldanda Canal and its outlets. The soil type of each plot was somewhat similar. Quality seeds certified by the Government Department of Agriculture, Orissa, of ribbed gourd were sown. Machans of 1.05 metres high were erected for the spread of the ribbed gourd. The fields were fenced all around to prevent cows and buffaloes etc. from damaging the plants. No insecticide was applied during the period of the experiment, June to June, 1977-79.

Orissa has three principal seasons viz., monsoon or rainy (June-September), post-monsoon or winter (October-January) and pre-monsoon or summer (February-May) (Lenka, 1976). Although ribbed gourd is grown throughout the year, the growth and yield of the fruits is the best and highest during the rainy season. The dates of sowing of seeds were same for all the experimental fields and were as follows: 15.5.99, 20.8.99, 24.11.77, 28.2.78, 5.5.78, 8.8.78, 11.11.78 and 16.2.79.

Adult beetles were counted directly on 100 leaves at random once a week on Sundays.

OBSERVATIONS AND DISCUSSION

Weekly observations of population count of adult beetles on 100 leaves selected at random in each plot are set in Table 1. In 1977, the first appearance of *E. dodecastigma* was recorded on June 19 while that in 1978 on June 18. The last infestation of the pest was observed in 1977 on 18 December and in 1978 on 24 December.

Thus, the period of infestation lasts from the second week of June to the third week of December. The pattern of infestation in the three plots in the two consecutive years was almost the same. The beetle species was not recorded on the host-plants in any of the plots during the period January to mid-June. The population was at the lowest ebb in October and December. During 1977 maximum infestation of adult beetles occurred in July on two plots (F_1 and F_2) and in September in the third plot (F_3) while, in 1978 in November in all the three plots. The meteorological conditions in July 1977 were maximum temperature 31.41°C (Range : 26.2°C - 34.3°C), minimum temperature 25.78°C (Range : 23.2°C - 27.6°C), hours of sunshine 3.05 hours (Range : 0-8.5 hrs), relative humidity 89.42% (Range : 80-98%) and rainfall 13.98 mm (Range : 0-87.3 mm). In September, 1977, the records were, maximum temperature 31.66°C, Range:27.7°C-34-4°C minimum temperature 24.83°C (Range: 21.2-27°C) hours of sunshine 5.32 hrs (Range : 0-10.1), relative humidity 86.83% (Range:80-98%) and rainfall 14.68 (0-96.1 mm) in November, 1978, the maximum temperature showed 31.04°C) (Range : 28.6-33.4°C), minimum temperature 20.39° C (Range : 16.3-23.5°C), hours of sunshine 8.48 (Range : 2.8-10.2 hrs), relative humidity 78.33% (62-91%) and rainfall 0.-0.02 mm.

A statistical analysis of weekly population using $x + \frac{1}{2}$ transformation is presented in Table 2. It shows that the critical difference for weeks at 5% significance is 0.39 in 1977 and 0.49 in 1978; at 1% significance 1.19 in 1977 and 0.66 in 1978, thus indicating no significant difference between the mean population in the three different plots. However, it reveals significant difference between the mean of weekly population.

The population showed four peaks during each season of infestation, viz., in 1977 on 10.7.77, 4.9.77 and 20.11.77 in all the three plots, an additional peak on 18.9.77 in F_2 and F_3 and on 25.9.77 in F_1, and in 1978 on 20.8.78, 10.9.78 and 12.11.78 in all

three fields, with an additional peak was on 16.7.78 in F_1 and on 23.7.78 in F_2 and F_3 (Table 1 and 2 and Fig. 1 A, B, C).

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REFERENCES

Behura, B.K., Dash, B.K. and Satapathy, N.C. 1975. On the sexual dimorphism of *Epilachna dodecastigma* Wied. *Prakruti Utkal University J. Sc.*, 12 (1 & 2): 117-122.

Lenka, D., 1976. Variation of annual rainfall, aridity, index and precipitation effective index in Orissa. *Prakruti Utkal University, J. Sc.* 13 (Published in March, 1981): 83-96.

Sengupta, G.C. and Behura, B.K. 1957. *Annotated list of crop pests in the state of Orissa*, Entomological Society of India Mem. (5), New Delhi: 1-44.

Table No. 1

Number of adults of *Epilachna dodecastigma* Wied counted on *Cucumis sativus* Linn. on hundred lives selected at random leaves in each of the three experimental fields. (F_1, F_2 and F_3)

Date	F_1	F_2	F_3	Date	F_1	F_2	F_3
5.6.77	0	0	0	4.6.78	0	0	0
12.6.77	0	0	0	11.6.78	0	0	0
19.6.77	8	6	7	18.6.78	0	3	2
26.6.77	12	11	14	25.6.78	7	7	10
Total for June	20	17	21		7	10	12
Mean for June	5	4.25	5.25		1.75	2.5	3
3.7.77	22	23	21	2.7.78	14	13	16
10.7.77	46	39	44	9.7.78	18	17	23
17.7.77	27	24	27	16.7.78	21	23	28
24.7.77	30	24	19	23.7.78	29	31	32
31.7.77	22	20	14	30.7.78	33	24	23
Total for July	147	130	125		115	108	122
Mean for July	29.4	26	25		23	21.6	24.4
7.8.77	15	13	11	6.8.78	34	31	32
14.8.77	20	18	17	13.8.78	39	40	37
21.8.77	27	35	30	20.8.78	51	49	47
28.8.77	30	38	34	27.8.78	36	32	30
Total for August	92	104	92		160	152	146
Mean for August	23	26	23		40	38	36.5
4.9.77	44	48	48	3.9.78	52	40	38
11.9.77	16	22	21	10.9.78	51	45	45
18.9.77	32	33	27	17.9.78	33	37	32
25.9.77	44	17	20	24.9.78	20	30	23

Date	F_1	F_2	F_3	Date	F_1	F_2	F_3
Total for September	136	120	116		156	152	138
Mean for September	34	30	29		39	38	34.5
2.10.77	18	27	18	1.10.78	16	17	17
9.10.77	8	15	12	8.10.78	13	13	12
16.10.77	6	8	14	15.10.78	16	21	19
23.10.77	8	7	8	22.10.78	22	25	26
30.10.77	5	3	4	29.10.78	24	32	33
Total for October	45	60	56		91	108	107
Mean for October	9	12	11.2		18.2	21.6	21.4
6.11.77	11	8	10	5.11.78	25	37	35
13.11.77	7	12	8	12.11.78	30	44	38
20.11.77	4	7	8	19.11.78	22	31	31
27.11.77	4	5	4	26.11.78	15	26	20
Total for November	26	32	30		92	138	124
Mean for November	6.5	8	7.5		23	34.5	31
4.12.77	4	9	4	3.12.78	15	22	19
11.12.77	2	7	2	10.12.78	11	19	13
18.12.77	2	4	2	17.12.78	5	15	12
25.12.77	0	0	0	24.12.78	1	4	4
				31.12.78	0	0	0
Total for December	8	20	8		32	60	48
Mean for December	2	5	2		6.4	12	9.6

Table No. 2
Showing transformed *E. dodecastigma* population for each week from each field for yearly recorded data

Weekly population for weeks	Year 1977-78	Year 1978-79
W1	3.39	2.54
W2	4.76	3.34
W3	5.72	4.18
W4	7.56	4.67
W5	8.16	5.46
W6	5.57	5.67
W7	5.07	5.24
W8	4.70	4.81
W9	5.14	6.59
W10	6.20	5.11
W11	6.47	5.84
W12	7.30	6.57
W13	4.83	5.37
W14	5.82	4.74
W15	5.41	4.63
W16	5.33	3.67
W17	3.57	4.49
W18	3.47	5.05
W19	3.13	5.67
W20	2.71	5.93
W21	4.63	6.64
W22	5.30	6.04
W23	5.49	5.20
W24	4.09	4.84
W25	3.24	4.01
W26	2.49	3.34
W27	1.17	

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