

UNIVERSITY OF RAJASTHAN STUDIES



EDITORIAL BOARDS

Chief Editor—Dr. S. P. Varma.

ARTS.

I. Humanities:

1. Dr. D. K. Sen, Reader, University Teaching Department of English, Jaipur.
2. Dr. Mata Prasad, Prof. & Head of the University Teaching Department of Hindi, Jaipur.
3. Dr. P. L. Bhargava, Officiating Head & Reader of the University Teaching Department of Sanskrit, Jaipur.
4. Shri V. V. John, Principal, M. B. College, Udaipur.
5. Shri R. S. Kapur, Principal, Maharaja's College, Jaipur.
6. Dr. R. P. Singh, Principal, Government College, Kota.
7. Dr. V. P. S. Raghuvanshi, Officiating Head & Reader of the University Teaching Department of History, Jaipur.

(General Editor).

II. Social Sciences:

1. Dr. T. K. N. Unnithan, Officiating Head & Reader of the University Teaching Department of Sociology, Jaipur.
2. Prof. M. V. Mathur, Head of the University Teaching Department of Economics & Public Administration, Jaipur.
3. Prof. S. D. Derashri, Vice-Principal, S. M. K. College, Jodhpur.
4. Prof. Atal Behari Mathur, Head of the Department of Political Science, Government College, Ajmer.
5. Dr. S. P. Varma, Director, School of Social Sciences, and Head of the University Teaching Department of Political Science, Jaipur.

(General Editor).

III. Natural Sciences:

1. Dr. G. C. Patni, Officiating Head and Reader of the University Teaching Department of Mathematics, Jaipur.
2. Dr. K. P. Rode, Head of the University Teaching Department of Geology, Udaipur.
3. Dr. S. M. Mitra, Principal, Birla College of Science, Pilani.
4. Dr. J. N. Gaur, Officiating Head and Reader of the University Teaching Department of Chemistry, Jaipur.

(General Editor).

IV. Biological Sciences:

1. Dr. C. V. Subramanian, Head of the University Teaching Department of Botany, Jodhpur.
2. Dr. P. N. Mathur, Professor of Zoology, Government College, Ajmer.
3. Dr. L. S. Ramaswami, Head of the University Teaching Department of Zoology, Jodhpur.

(General Editor).

UNIVERSITY OF RAJASTHAN STUDIES

BIOLOGY

VOLUME V



JAIPUR

1961-62



Library

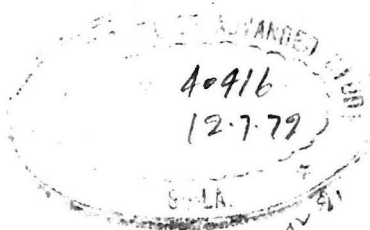
IIAS, Shimla

PH 378 J 199 U



00040416

73



PH²²⁻¹²⁻⁸¹
378.
J199U

CONTENTS

	PAGE
1. Hydrophytes of Bharatpur by SHANTI SARUP	1
2. Disease of Tropical Aquarium Fishes. by A. K. DATTA GUPTA, P. K. B. MENON & RAJ TILAK	12
3. Somatic Chromosomes of <i>Dieffenbachia Jenmanii</i> Veitch by M. C. JOSHI	17
4. The Osteology and the Musculature of the Posterior Appendicular Region of <i>Meriones Hurrianæ</i> Jerdon by RAJ TILAK	19
5. The Histology and the Probable Functions of the skin in the Hedgehog, <i>P. M. Micropus Blyth</i> by B. B. GUPTA.	36

HYDROPHYTES OF BHARATPUR

A Preliminary Study.

By

Shanti Sarup,

Principal,

M. S. J. College, Bharatpur.

Bharatpur is situated in the east of Rajasthan. It is the gateway of Rajasthan from Agra and Mathura. The town lies in the latitude 27° .— $37''$ and longitude 77° .— $33''$. Its immense mud ramparts still stand with a ditch alround the city. Some habitats stand almost in the water of the ditch.

It is bounded on the north by Gurgaon District of the Punjab, on the North-East by Mathura (22 miles) and Agra (34 miles) districts of U. P., on the south by Karauli and Dholpur on the south-west by Jaipur and on the north-west by Alwar.

The town lies on low lying ground more or less at the confluence of the waters of the rivers Ruparal and Banganga, those of the former being stored in the Moti Jheel Bund, about a mile due north of the city while those of the latter, being brought from the Ajan Bund to the Atal Bund adjoining the city, furnish the moat around the Fort with a large supply of water annually which replenish the wells used by the inhabitants for drinking water. The deep wells are saline so are unfit for drinking. In a year of excessive rain (Over 60"—1958) and floods the city is surrounded by sheet of water for miles in the inundated land.

This low lying position of town has been very advantageous in times of war as water in the Bunds or hills in the vicinity could be easily allowed to pour into the earthwork ditch as a fortification.

A high metalled road has been built round the town. Inside this road is a wide (about 2 hundred feet) and deep ditch and mud wall of great height and thickness which aids in fortifying the place and which serves as an ideal habitat for water plants.

The environs of Bharatpur town are easily flooded from the rainy season rivers and a chain of swamps, particularly in the north exit. The

low lying land lies in swamp but the floods are controlled and only moderate inundation of the low lying land to the south west of the town is allowed from which source the Fort Moat is filled annually. The outskirts of the town used to be flooded from the North from the neighbouring bund, as well as from the south-west with the object of defence. The ditch outside the ramparts is filled with water and *Ichhornia crassipes* Solms, dominates the entire inner Fort Moat and outside ditch circling the town.

Three large torrential streams enter the state across its western border the Ruparel at the northern and, the Banganga river in the southern part and Gambhir river at the southern extremity. These streams flow in the monsoon season only. The Ruparel floods are diverted by the Sikri Bund, a fine embankment which extends for 12 miles along its western boundry and are properly distributed by irrigation channels.

BANGANGA RIVER :—The Banganga River spills freely over its northern bank as it passes through the district and about midway in its course eastwards the river has left its old channel and now flows in a northerly direction towards Uchain along the Bayana-Uchain road. The diversion of the river has been encouraged artificially by the use of the Bayana-Uchain road as a training bank. This road is carried on a raised embankment from Nekput to Sesar, with flood regulators discharging in an easterly direction. The flood water so discharged is again impounded and distributed by other works, the largest of which is the Ajan Bund, a fine embankment extending for 12 miles across the direction of flow. Ajan Bund, which commands the whole vicinity of the Bharatpur town, contains a number of sluices and weirs through which the flood water can be released to irrigate the land in rear during flood time, and the sluices are also employed to empty the basin of the bund, which has a contour of 14 square miles.

The Ajan bund and other reservoirs are emptied at the end of October, and the flooded land on both sides is then ploughed and sown. The influence of the Banganga floods is specially valuable in replenishing the water in wells and in saturating the soil for agricultural purposes.

THE KELADEO JHEEL :—3 miles to the south of the Bharatpur town is a notable depression flooded annually from the Banganga River via the Ajan Bund. The 'Jheel' is now drained so that water can be stored in it to desired depth and it is partitioned by small embankments into pockets which are flooded and filled separately. The 'Jheel' is flooded partly for sport and partly for growth of grass for

the wild cattle and game confined in the forest enclosures—the Ghanna which is a vast preserve of scrub forest and the famous bird sanctuary. There are over 100 blocks which are inundated with water from Ajan Bund and continuously replenished with water. These are ideal places for water plants and present wonderful associations for the tourist and the students.

Cuts and channels from the Banganga river and the Gambhir river provide water either for being held up in shallow reservoirs or pockets or is spread out over the land. There are other numerous local catchments or bunds which also provide suitable habitat for water plants.

THE BARETHA BUND :—A large storage reservoir is situated 6 miles west of Bayana. It has a catchment area of 70 square miles, a storage basin of 1,500 million cubic feet capacity, a water-spread when full of 4 square miles and a depth of 40 feet below escape level. Irrigation from this bund takes place continually throughout the year for both *rabi* and *Kharif* crops. For purposes of the study it forms a separate unit itself and is reported upon separately.

Considerable work has been done in the western countries on the systematics and distribution of the water plants. The vegetation of the tropics and subtropical lakes has yet to be studied. Studies of the Hydrophytes of India have now begun receiving attention. Mukerjee's work (1926) on the vegetation of the Dal Lake region of Kashmir dealt with the factors operating and their effect on the growth and development of plant associations in the region as well as a detailed study of the principal plant communities and the economic products of Kashmir. Pioneer work on plant ecology of water plants was thus started by late Dr. S. K. Mukerjee but his sad demise in the prime of life cut short a promise of school of plant ecologist. A work of more comprehensive nature is that of Biswas and Calder (1937) on the Water and Marsh Plants of India. The book had gone out of print and has now been revised. Some contributions on the different aspects of the fresh water hydrophytes of different places (Gunjekar and Ladwa 1947, Lakshmanan 1950, Misra 1946, Mirashi 1954, 1957, 1959 Sarup 1957) in India have appeared from time to time. Aquatic and Marsh species have been mentioned by Hooker (1880) Cooke (1903) Haines (1925) and others. Navalkar (1940) and Bharucha (1940) 1941, 1942, 48, 49 and 1950 have published a series of papers on studies in the Ecology of Mangroves. Earlier Blatter (1905) had discussed the mangroves of Bombay Presidency and their Biology. Similar studies might well be

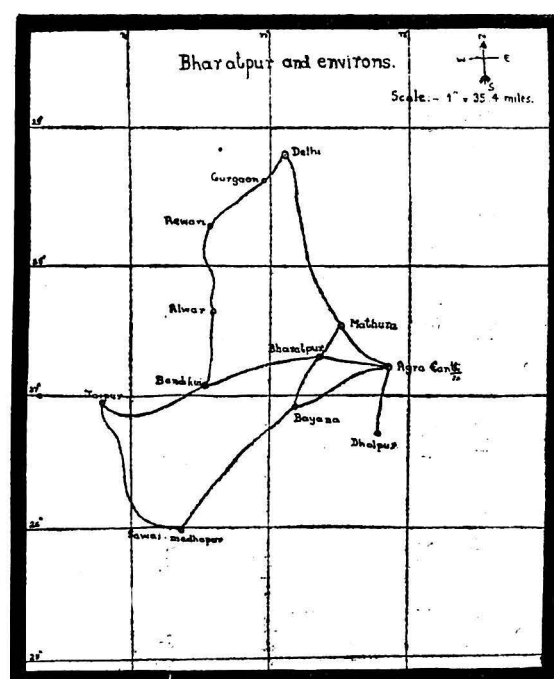
conducted for other parts of India. Miss. V. J. Kumar has just submitted a thesis on the Ecological studies of the Hydrophytes of Bombay for the M.Sc. Degree of the University of Bombay.

The writer (1957) studied the hydrophytes of Jodhpur and its neighbourhood. Bharatpur is an interesting place for their study and the relation of environmental factors to aquatic plants. Welch (1935) has discussed the nature of fresh water environments, the influence of physical and chemical conditions on the biota and the role of vascular aquatic plants. Methods of determining the environmental conditions of fresh water habitats are described by Welch (1949). Shirley (1951) studied the penetration of light into water and means of its measurements. The methods of seed germination, environmental requirements for breaking dormancy, and the relation of progression and accession of water levels to germination of seeds, sprouting, survival and growth forms of wet land and aquatic plants are some of the many aspects of the problem.

At present only a list of the water plants found here is given below as a result of the preliminary survey of the area. Water plants are here considered as plants that "grow in water, in soil covered with water and in soil that is usually saturated"—Weaver and Clements 1938. According to this definition hydrophytes would include both wet land and aquatic species. An account of their ecology, phenology and physiological anatomy would be given later on. These plants occur in the artificial lakes, reservoirs, swamps, pools and channels.

The following aquatic associations are common:—

1. *Ichhornia crassipes* Solms. Pure association.
2. *Hydrilla verticillata*. Casp. „ „
3. *Vallisneria spirallis*. Linn. „ „
4. *Ipomea-Limnanthemum* Association.
 - (a) *Ipomea aquatica*. Forsk.
 - (b) *Limnanthemum Lymphoides* Linn.
 - (c) *Hydrilla verticillata* Prosl.
 - (d) *Lemna minor*. Linn.
5. *Marsilea minuta* pure association.
6. *Typha angustifolia* Katz pure association.
7. *Ipomea-Ceratophyllum* Association.
 - (a) *Ipomea aquatica* Forsk.
 - (b) *Ceratophyllum demersum* Linn.
 - (c) *Limnanthemum Lymphoides* Linn.
 - (d) *Lemna minor*.
 - (e) *Sagittaria saggitifolia*.



The average rainfall of Bharatpur is annually about 25", which is generally exceeded in many years in (1958) the rainfall exceeded 60"

or

TABLE 1

RAINFALL IN :—

1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
23.35"	37.36"	31.24"	34.25"	32.19"	12.62"	14.90"	24.74"	26.34"	21.85"

MONTHLY RAINFALL :—

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Formal
B. Tehsil—1890	00.49	00.34	00.39	00.01	00.63	04.51	08.81	08.07	03.90	00.14	00.11	00.38	27.38
City —1896	11.00	00.00	00.30	00.00	00.00	07.15	06.55	00.70	02.50	00.00	00.00	00.15	23.35
1899	00.00	00.00	00.00	00.00	01.81	11.72	07.69	00.80	00.50	00.00	00.00	00.00	22.52
1958	3.0	6.3	1.0	0	0	0.4	388.0	333.0	274.0	34.6	0	3.0	—

Climatic data for Bharatpur (Agra) for the year 1958 is given in Table No. 2 below :

TABLE 2

Name of months.	Temperature			Relative Humidity		Rainfall Millimeters.
	Max. OC.	Min. OC.	Mean. OC.	0830 hrs. %	1730%	
January	24.0	9.3	16.7	75	44	3.0
February	26.6	10.3	18.5	54	27	6.3
March	33.2	16.7	24.9	42	18	1.0
April	39.9	23.1	31.5	33	16	0.0
May	42.1	26.6	34.3	29	19	0.0
June	42.4	30.2	36.3	40	20	0.4
July	34.2	26.5	30.3	81	71	388.0
August	32.1	25.7	28.9	86	76	333.0
September	31.6	25.0	28.3	85	76	273.0
October	31.2	20.2	25.7	69	49	34.6
November	28.3	12.2	20.3	59	35	0.0
December	24.3	10.2	17.3	77	50	3.0

WATER PLANTS FOUND AT BHARATPUR.

- | | |
|-------------------------------------|--|
| I NYMPHAEACEAE | 1. <i>Nymphaea stellata</i> Willd. |
| | 2. <i>Nymphaea lotus</i> Linn. |
| II CAPPARIDACEAE | 3. <i>Nelumbium speciosum</i> Willd. |
| III ROSEACEAE | 4. <i>Cleome chelidoni</i> Linn. |
| IV LEGUMINOSAEAE
(PAPILIONACEAE) | 5. <i>Potentilla desertorum</i> Bunge. |
| V ELATINACEAE | 6. <i>Sesbania aegyptiaca</i> Pers. |
| | 7. <i>Bergia ammanioides</i> Roxb. |
| | 8. <i>Bergia odorata</i> Edgew. |
| VI LYTHRACEAE | 9. <i>Ammannia baccifera</i> Linn. |
| | 10. <i>Ammannia pentandra</i> Roxb. |
| | 11. <i>Ammannia multiflora</i> Roxb. |
| VII ONAGRACEAE | 12. <i>Trapa bispinosa</i> Roxb. |
| | 13. <i>Jussiaea suffruticosa</i> Linn. |
| VIII UMBELLIFERAE | 14. <i>Hydrocotyle asiatica</i> Linn. |
| IX COMPOSITAE | 15. <i>Xanthium strumarium</i> Linn. |
| | 16. <i>Eclipta erecta</i> Linn. |
| | 17. <i>Eclipta alba</i> Hassk. |
| | 18. <i>Caesulia axillaris</i> Roxb. |
| X GENTIANACEAE | 19. <i>Canscora Diffusa</i> Br. |
| | 20. <i>Limnanthemum</i>
<i>nymphaeoides</i> Link. |
| | 21. <i>Limnanthemum</i>
<i>parvifolium</i> Griseb. |
| | 22. <i>Limnanthemum</i>
<i>cristatum</i> Griseb. |
| XI CONVULVULACEAE | 23. <i>Ipomaea aquatica</i> Forsk. |
| | 24. <i>Evolvulus alsinoides</i> Linn. |
| XII LENTIBULARIACEAE | 25. <i>Utricularia stellaris</i> Linn. |
| | 26. <i>Hygrophila heterophylla</i> |
| XIII ACANTHACEAE | 27. <i>Asteracantha longifolia</i> Nees. |
| XIV VERBENACEAE | 28. <i>Lippia nodiflora</i> Rich. |
| XV SCROPHULARIACEAE | 29. <i>Torenia bicolor</i> Dalz. |
| XVI AMARANTACEAE | 30. <i>Alternanthera sessilis</i> Br. |
| | 31. <i>Alternanthera triandra</i> Lam. |
| | 32. <i>Polygonum glabrum</i> Willd. |
| | 33. <i>Polygonum plebejum</i> Br.
Var <i>Indica</i> Hook. |
| XVII POLYGONACEAE | 34. <i>Polygonum amphibium</i> Linn. |
| XVIII CERATOPHYLLACEAE. | 35. <i>Ceratophyllum demersum</i> Kleja |

MONOCOTYLEDONEAE.

- | | |
|-----------------------|---|
| XIX HYDROCHARITACEAE | 36. <i>Hydrilla verticillata</i> Casp. |
| | 37. <i>Vallisneria spiralis</i> Linn. |
| XX COMMELINACEAE | 38. <i>Commelina nudiflora</i> Linn. |
| XXI PONTEDERIACEAE | 39. <i>Eichhornia crassipes</i> Solms. |
| XXII TYPHACEAE | 40. <i>Typha angustifolia</i> Kurz. |
| XXIII LEMNACEAE | 41. <i>Lemna minor</i> Linn. |
| | 42. <i>Wolffia arrhiza</i> Wimm. |
| XXIV POTAMOGETONACEAE | 43. <i>Potamogeton crispus</i> Linn. |
| | 44. <i>Potamogeton pectinatus</i> Linn |
| | 45. <i>Potamogeton natans</i> Linn. |
| XXV NAIADACEAE | 46. <i>Naias minor</i> Allioni. |
| | 47. <i>Naias graminea</i> Del. |
| | 48. <i>Najas australis</i> Bory. |
| XXVI CYPERACEAE | 49. <i>Cyperus pygmaeus</i> Rohl. |
| | 50. <i>Cyperus aristatus</i> Rottb. |
| | 51. <i>Cyperus Iria</i> Linn. |
| | 52. <i>Cyperus Bulbosus</i> Vahl. |
| | 53. <i>Fimbristylis tenera</i> Boeck. |
| | 54. <i>Scirpus quinquefarius</i> Ham. |
| | 55. <i>Scirpus Hallii</i> Gray. |
| XXVII GRAMINEAE | 56. <i>Sporobolus glaucifolius</i>
Hochst. |
| | 57. <i>Eragrostis pilosa</i> Beauv. |
| | 58. <i>Andropogon Squarrosus</i> Linn |
| MARSILEACEAE | 1. <i>Marsilia minuta</i> |
| | 2. <i>Marsilia minuta</i> Var. minor. |

ALGAE

- | | |
|-----------|-----------------------------------|
| CHARACEAE | 1. <i>Chara zeylanica</i> |
| | 2. <i>Chara Fragilis.</i> |
| | 3. <i>Chara braunil.</i> |
| | 4. <i>Nitella batrachosperma.</i> |

REFERENCES

- Bharucha, F. R. & B. S. Navalkar 1942 Studies in the Ecology of Mangroves. Jour. Univ. of Bombay Vol. X Pt. 5
- Biswas, K. & Calder, C. 1937 Hand book of common water and Marsh plants of India and Burma Govt. Press Delhi.
- Blatter, E. 1905 The mangroves of Bombay Presidency and its Neighbourhood. Bomb. Nat. Hist. Soc. Vol. XVI. PP. 644-656.
- Drake, Brockman H. E. A Gazetteer of Eastern Rajputana, Ajmer.
- Gunjikar; L. k. & H. L. Ladwa. 1947 Studies in the Phanerogamic flora of the Dharwar Tanks. Proc. Ind. Sc. Cong. 1942 P. 167.
- Haines, H. H. 1925 The Botany of Bihar and Orissa. London 1925.
- Hooker, J. D. 1880 The flora of British India, London.
- Kumar Veerwala (Miss) 1959 An Ecology of the Hydrophytes of Bombay M. Sc. Thesis University of Bombay. (unpublished)
- Lakshman, C. 1950 Studies in the Hydrophytic Vegetation of S. India. Proc. Ind. Sc. Cong. P. 11.
- Mirashi M. V. 1954 Studies in the Hydrophytes of Nagpur J. India Bot. Soc. 33. 299-308.
- Mirashi M. V. 1957 Studies in the Hydrophytes of Umred J. India Bot. Soc. 36..396.407.
- Mirashi M. V. 1958 Studies in the Hydrophytes of Manser, J. Biol. Sci. 1, No. 1.
- Misra, R. D. 1946 The Ecology of Low Lying Lands, Indian Ecologist Vol. 1, No. 1
- Mukerjee, S. K. 1926 The Vegetation of the Dal Lake Region of Kashmir. Proc. British Ecological Soc. Manchester, Jan. 1926.
- Navalkar B. S. 1940-41 Studies in the Ecology of Mangroves, Jour. University of Bombay Vol. VIII 49 & 50 Vol IX and Later. 1951, Jour Bombay Nat. History Soc. Vol 50 1953 and 51.

- | | | |
|------------------------------------|------|--|
| Shanti Sarup | 1957 | Hydrophytes of Jodhpur.
University of Rajasthan Studies (Botany
Section) Vol III Jaipur 1957. |
| Shirley, H. L. | 1935 | Light as an ecological factor and its
measurment, 1. Bot. Rev. 1 : 35-381 :
1935 11. Bot : Rev. 11: 497-532, 1945. |
| Weaver, J. E. &
Clements, F. E. | 1938 | Plant Ecology, McGraw-Hill Book Co.
London and New-York. |
| Welch P. S. | 1952 | Limnology McGraw-Hill Book Co.
London and New-York. |
| Welch P. S. | 1948 | Limnological Methods, Blakistan Co.
Philadelphia. |
-

DISEASE OF TROPICAL AQUARIUM FISHES. PART I. STUDIES ON THE 'CEPHALIC ULCERS' AND FIN-ROT OF SOME AQUARIUM FISHES.

By

A. K. Datta Gupta, P. K. B. Menon and Raj Tilak

*Department of Zoology,
Birla College, Pilani.*

INTRODUCTION.

Aquarium fishes of India often suffer from a variety of diseases depending upon the conditions they live in. These diseases are generally caused by fungi, protozoans, worms and arthropods. There is very little knowledge about these diseases or their preventive measures.

This paper deals with a study of 'ulcers' of the head and rotting of the fins of some aquarium fishes. Observations have been made on the nature of the diseases and simple remedial treatments have been described.

OBSERVATION.

The material for the present study was obtained from the aquarium of the Zoology Department of Birla College, Pilani. The fishes inhabited tanks measuring 6 ft. $\times$ 2 ft. $\times$ 2 ft. The tanks had the usual stone-chip beds and water plants namely, *Hydrilla* and *Vallisneria*. The temperature of the water in the tanks fluctuated from 16.5 to 23.5°C during the period of observation.

Cephalic 'ulcers' of gold fishes.

History and description of the disease. In the 2nd week of November, 1958, two mature gold fishes, *Carrassius auratus*, about 6—7½ inches long were observed to suffer from 'ulcer' above their frontal bones (Fig. 1) The fishes were very inactive although they used to feed as normal. The usual treatment of touching the affected parts with 1% potassium dichromate solution was given to them and the treated fishes

were transferred to a very dilute solution of the same. The fishes did not respond favourably. A similar treatment with acriflavin was found unsuitable as the fishes reacted unfavourably in the form of acute restlessness. The fishes did not survive the treatment and eventually died.

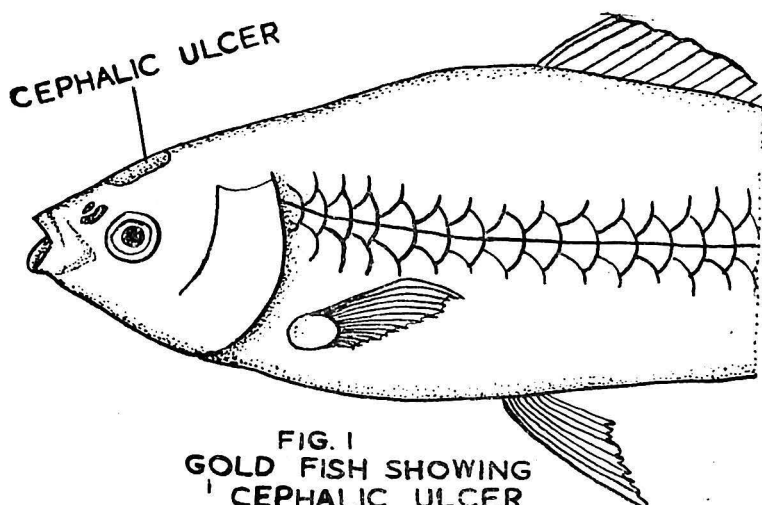


FIG. 1
GOLD FISH SHOWING
CEPHALIC ULCER

During this time other gold fishes were kept under careful observation. Some of these fishes preferred the surface of the water to the bottom and their movement was particularly slow as if they were almost benumbed. No other external symptoms were observed.

In course of two days an inflammation of the skin was observed above the frontal bones. The region of inflammation had deep pink colour. The advanced nature of ulceration was marked by the fading of the pink colour to a pale white in the centre, the pink colouration being pushed to the periphery. The biggest size of 'ulcer' observed was 13—14 mm along the longest diameter. Besides, such ulcerations have always been found to be accompanied by external appearance of network of blood capillaries in any part of the body.

Treatment. Different concentrations of common salt (NaCl) have been used to treat the affected fishes. The details of the plan of treatment have been presented in Table 1. Solutions of salt were made with water of the tank in which the affected fishes lived. Treated fishes were transferred to the tank and were not kept isolated in a separate tank. Fishes of the different tanks had these 'ulcers' in different stages of development,

hence the concentration of NaCl or the period of treatment could not be kept uniform in order to treat the fishes. Treatment of the fishes with less advanced ulcerations were started with 40 gm. of salt in 4 gal. of water. The treatments were continued everyday for a period ranging from 17 to 25 days till the ulcerations completely disappeared and the fishes restored to their normal life and look.

TABLE 1

Detailed plan of treatment of gold fishes with NaCl.

No. of treatment.	Concn. of NaCl.	Duration of treatt./day.	Period of treatt.	Remark.
I	60 gm./4 gal.	7 min.	2 days	Body colour brightened. Signs of improvement.
II	50 gm./4 gal.	5-7 min.	4 days	
III	40 gm./4 gal.	5-7 min.	4 days	
IV	20 gm./4 gal.	5 min.	8 days	'Ulcer' disappeared. Completely cured.
V	10 gm./4 gal.	5 min.	5 days	

Fin rot.

Fin rot of gold fish.

History and description of the disease. A case of the rotting of the dorsal fin of a veil-tailed gold fish of $2\frac{1}{2}$ inches in length was observed in February, 1960. The fish showed peculiar slow movement with its body tilted on one side. There was a fluffy outgrowth on the dorsal fin and a considerable part of the body around the fin was dull pink in colour and showed signs of decomposition. Treatment of NaCl and subsequently with potassium dichromate solution failed to revive the condition of the fish.

The fluffy outgrowth was due to fungal infection. The fin membrane had completely degenerated and the fin rays were disorderly arranged. The muscle and skin of the surrounding area were teased and examined under microscope. The tissue contained numerous sporangia and penetrating hyphae of *Saprolegnia*. A similar examination of kidney, liver, ovary, gills and digestive tract revealed that the kidney and liver are infected by the said fungus although the infection of the kidney was more evident than that of the liver.

Fin rot of mid-night mollies (*Mollienesia*).

History and description of the disease. The mollies suffer from this disease very often. Early stages of infection have been marked by the fading of the pigment of the body and of tail in particular. Later, white astral outgrowth appeared in the tail which degenerated. This outgrowth was found to be of the growing hyphae of *Saprolegnia*. Axelrod et al, (1955) have described such disease due to two infections, the fungal infection preceded by a bacterial infection which in the present case may be a probable cause of the characteristic loss of pigment.

Treatment. In early stages of infection the fishes were treated by touching the affected parts with acriflavin solution (1 tablet in 330 ml of water) and later the treated fishes were transferred to a very dilute solution of the same. The fishes did not show any sign of improvement.

Surgical method proved very effective special care being taken to ensure that all infection had been removed. The wound was treated by touching with 1% potassium dichromate solution. The treated fishes were then transferred to a solution of NaCl ($3\frac{1}{2}$ gm. per gallon) instead of the usual acriflavin solution (Axelrod et al, 1955). The fishes were kept in this solution for 4-5hr/day for a period of 14 days.

Interesting observations have been made after the mollies were completely cured. They are (1) elongation of caudal peduncle where the whole fin was mutilated and (2) truncation of the fin where part of the fin was mutilated.

GENERAL REMARKS

Common salt bath has been found to be a very effective remedial measure here and elsewhere (Khan, 1925) of the early stages of infection of the fishes. The condition of the fin rot of the dorsal fin of the gold fish may be regarded as a very advanced stage of infection. Treatment of such cases is particularly difficult as stronger solution of potassium dichromate or acriflavin cannot be applied successfully. External application of fungicides cannot cure the rotting of the fins if the growing hyphae penetrate deep into the muscles of the body. Removal of infected parts would not be a suitable method of treatment of such cases since the fishes cannot survive such surgical treatment.

Cephalic ulceration of the gold fishes is perhaps due to bacterial infection and since the site of infection is very superficial common salt bath proved remarkably effective. Common salt bath, however, failed

to cure extreme cases of infection. Should bones be affected due to deep ulceration salt bath cannot be an effective treatment. Treatment with potassium dichromate or acriflavin also was ineffective in these cases.

ACKNOWLEDGEMENT.

The authors record their gratefulness to Dr. S. M. Mitra, Principal, Birla College, Pilani, for his interest and encouragement throughout the work.

REFERENCES.

- Axelrod, H. R. & Schultz, P. L. 1955. Handbook of tropical aquarium fishes. Mc. Graw Hill Co Ltd. New York.
- Khan, H. M. 1929. Early stages in the development of the gold fish *Carrassius auratus*. Jour. Bom. Nat. Hist. Soc. 33, 614—617.

SOMATIC CHROMOSOMES OF DIEFFENBACHIA JENMANII VEITCH

By

M. C. Joshi,

Department of Botany,

Birla College,

PILANI Rajasthan)

So far the chromosome number of only one species of the genus *Dieffenbachia* *D. picta* Lodd. is known. It is $2n = 16$. The basic number for the genus is $n = 8$ (Darlington and Wylie, 1955).

The present investigation records the somatic number of *Dieffenbachia jenmanii* Veitch. (which is supposed to be *D. picta* (Lodd.) Schott var. *angustior*. Engl. sub. var. *Jenmanii* (Veitch) Engl. It is a rhizomatous, terrestrial aroid distributed throughout British Guiana, South America - particularly in the moist rain. The material was obtained from the Lalbagh Botanical Gardens, Bangalore.

Many drawings of well spread metaphase plates were made and the number was found to be $2n = 24$ (Fig. 1). This number tallies with the basic number given for the genus $n = 8$.

The karyotype can be classified as under: (Fig. 2).

Metacentric - large.....	3 pairs (A, B, C)
Metacentric - medium size.....	3 pairs (D, E, F)
Metacentric - but sub-median.....	2 pairs (G, H)
Acrocentric - small size.....	2 pairs (I, J)
Acrocentric - smallest.....	1 pairs (K)
Dissimilar pair (probably due to a shift in the centromere)-large size	1 pair (L)

Taking 8 as the basic number for the genus, this species appears to be a triploid.

My sincere thanks are due to Dr. B.N. Mulay, prof. B. V. Ratnam and to Dr. B. D. Deshpande for encouragement.

REFERENCE :

Darlington, C. D. & Wylie, A. P. 1955. *Chromosome atlas of flowering plants*''', George Allen and Unwin Ltd., London.

Text-Figures 1—2. Mitotic Chromosomes of *Dieffenbachia jenmanii* Veitch.

Fig. 1. Metaphase, polar view. Fig. 2. Idiogram.



FIG. 1.

0.01 m.

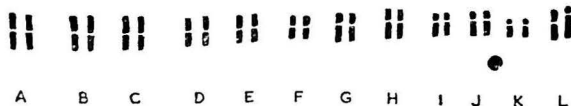


FIG. 2.

THE OSTEOLOGY AND THE MUSCULATURE OF THE POSTERIOR APPENDICULAR REGION OF *MERIONES HURRIANAE* JERDON

Raj Tilak

Department of Zoology

Birla College, Pilani

Introduction

The morphology of *Meriones hurrianæ* Jerdon has not been studied so far, though important contributions of this nature on other mammals have been made by parson (1892), Appleton (1922, 28), Haines (1934), Howell (1926), Hill (1937), Reed (1951), Greene (1955) and Sharma (1958). Taxonomic descriptions of this gerbil have been given by Jerdon (1867), Blanford (1888), Murray (1884), Ellerman (1947) and Chaworth and Ellerman (1947). The gerbil is a desert animal. It digs burrows and lives into them; hence the limbs are well developed. In the present paper the osteology and the musculature of the posterior appendicular region of this rodent has been described and correlated with its living habits.

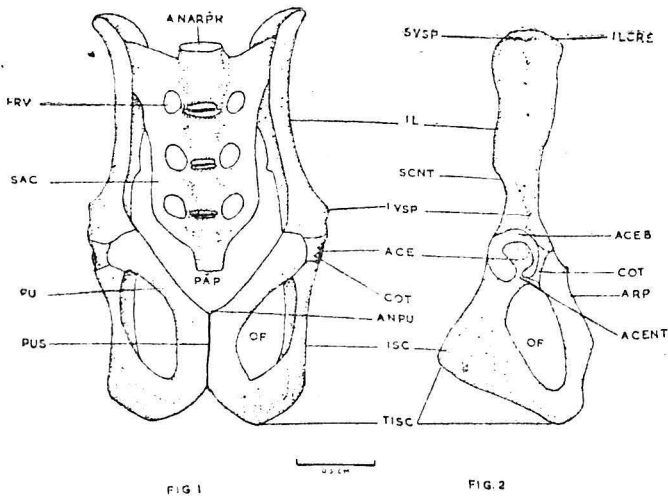
Material and Methods

The material for the present study was collected from the fields around Pilani. Studies were made with the help of alizarin and dry skeletal preparations and dissections. The terminology used by Greene (1955) has been adopted but the grouping of the muscles has been done according to their factions.

Observations

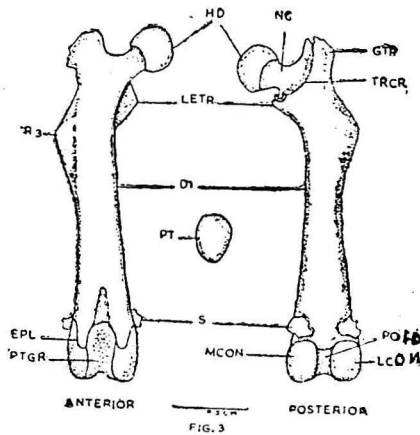
The osteology.

The sacrum (os coxae) (SAC, Fig. 1) consists of four well fused vertebrae. Its anterior ends are wing shaped and are in close contact with only one vertebra. The ilium (IL, Figs. 1, 2) extends upto the 6th lumbar vertebra. The iliac crest is convex and points laterally outwards. The ischium (ISC, Figs. 1, 2) is nearly triangular



1. Pelvic girdle and sacrum-ventral aspect.
2. Innominate of right side-lateral view.

with two ischial tuberosities, the dorsal one is larger than the ventral. Anteriorly it forms nearly half of the acetabulum. The cotyloid (acetabular bone) (COT, Figs. 1, 2) forms $\frac{1}{4}$ th of the acetabulum.



3. Tibio-fibula of left side-lateral and medial aspects.

The head (HD) of femur (FE, Fig. 3) is round with a small pit on its convex tip. The trochanters of femur are prominent and have rough attachment surfaces. The medial condyle (MCON) is slightly larger than the lateral (LCON). On the posterior side lies a sesamoid above each condyle. The patella (PT) is saddle shaped. The tibia and the fibula (TI, FI, Fig. 4) have fused distally through $\frac{2}{5}$ th of the total length of tibia. A pair of bony pieces lies between the articular epiphyses of tibia and femur which Howell (1926) called 'articular sesamoid' in wood rat. The lateral and the caudal fossae of tibia are deep.



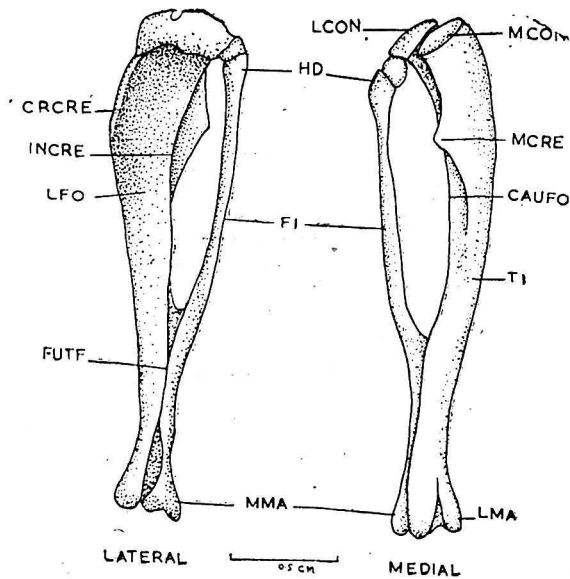


FIG 4

4. Femur of right side—anterior and posterior aspects.

The tarsals are arranged in two rows of 5 and 3 each. The tibiale (TI) lies just under and lateral to talus and navicular and articulates with the 1st cuneiform. The talus (TA, Fig. 5) forms the astragalus. The calcaneus (C) or the heel bone is the largest piece. Its posterior part, the tuber calcanei, is grooved at its tip for the passage of tendo calcaneus. The navicular (N) lies in front of the talus. The

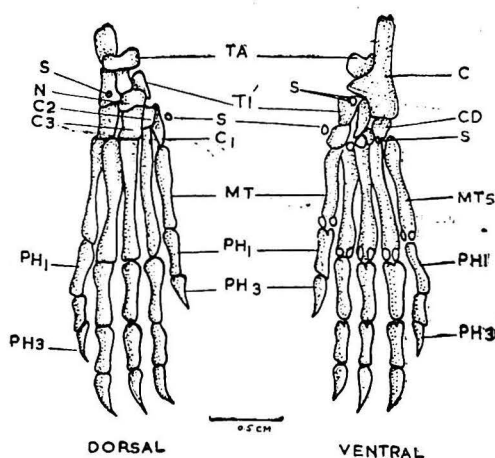


FIG. 5

5. Pes of right side—anterior and posterior aspects.

cuboid (CD) lies on the lateral side of the pes and articulates posteriorly with the calcaneus, medially with the 3rd cuneiform and anteriorly with the 5th metatarsal. There are 3 irregular cuneiforms (C1, C2, C3) in connection with the 1st, 2nd and the 3rd metatarsals respectively. The terminal phalanx of each digit bears a curved, pointed and elongated nail.

Musculature

The extensor system

The iliac group—The muscles of this group are Mm. psoas major, psoas minor, iliacus and quadratus lumborum which have been included in the posterior abdominal region by Greene (1955). In the present study they have been considered here because they have their attachments on the pelvic girdle and the femur. The attachments of these muscles are the same as described by Greene (1955).

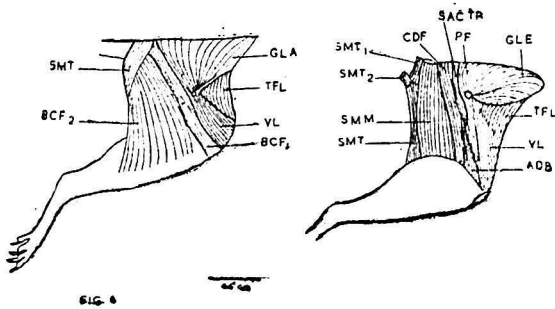


Fig. 7

6. Thigh musculature-lateral aspect-superficial layer.

7. Thigh musculature-lateral aspect-intermediate layer.

The gluteal region

The muscles included in this region are Mm. **extensor faciae latae** (TFL, Figs. 5, 10), **gluteus maximus** (GLA, Fig. 6), **gluteus medius** (GLE, Fig. 7), **piriformis** (PF, Figs. 7, 8), and **gluteus minimus** (GLI, Fig. 8). They have their origin and insertion similar to those of albino rat described by Greene (1955).

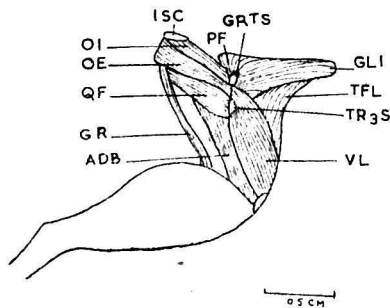


FIG. 8

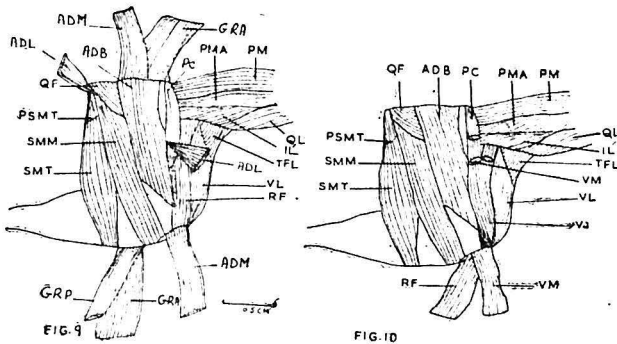
8. Thigh musculature-lateral aspect-deep layer.

The anterior flexor muscles

The attachments of Mm. **rectus femoris** (RF, Figs. 8-10), **vastus lateralis** (VL, Figs. 6-10), **vastus intermedialis** (VI, Fig. 9), and **vastus medialis** (VM, Fig. 9) are the same as in albino rat (Greene, 1955).

The anterior crural muscles of the leg

Except in size *Mm. tibialis anterior* (TIA, Figs. 12,13)' *extensor digitorum longus* (EDL, Fig. 14) and *extensor hallucis longus* (EHL, Fig. 14) do not differ from those of albino rat (Greene, 1955).



9. Thigh musculature-medial aspect (some of the superficial muscles cut).
10. Thigh musculature, medial aspect-deep layer.

The lateral crural muscles of the leg

Mm. peroneus longus (PL, Figs. 12,13), *peroneus digiti quarti* (PDQA, Figs. 12,13) and *peroneus digiti quinti* (PDQI, Figs. 12,13) do not show a significant difference from those of albino rat (Greene, 1955).

The dorsal muscles of the foot

The only muscle of this group is *M. extensor digitorum brevis* (EDB, Fig. 16) which is similar to that of albino rat.

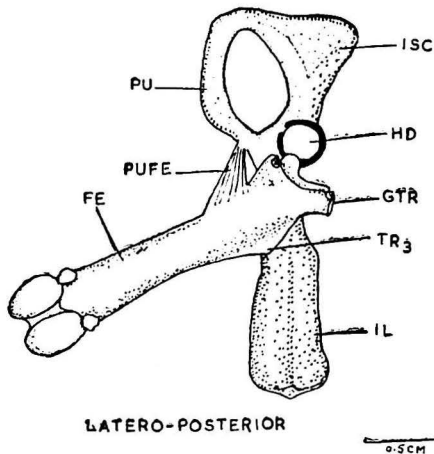


FIG II.

11. Thigh musculature, antero-posterior aspect, showing origin and insertion of M. Pubo-femoralis.

The Flexor system

The muscles of the gluteal region:- M. **pubo-femoralis** PUE:- (Fig. II) arises from ascending ramus of pubis and is inserted on the distal half of the shaft of femur. This muscle has neither been observed in albino rat (Greene, 1955) nor in pocket gopher (Hill 1937). M. **semi-tendinosus** (SMT, Figs. 6, 7, 9) arises by two heads; the principle head arises from the ischium and is joined by the accessory head which arises from the 1st two caudal vertebrae and the last sacral vertebra. This muscle is inserted on the medial side of the tibia. M. **biceps femoris** (BCF, Fig. 6) has an anterior thin and a posterior broad and thick part. Both the parts are closely applied to each other and are

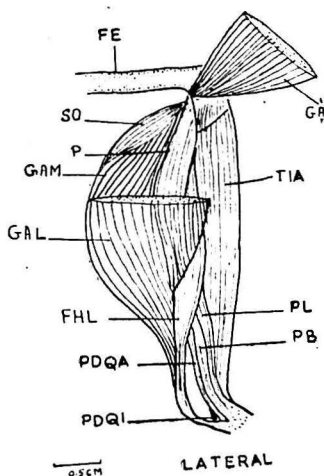


FIG. 12

12. Leg musculature-lateral aspect (lateral) head of gastrocnemius cut)

superficially fused. The anterior part arises from the sacral and the caudal vertebrae whereas the posterior part arises from the dorsal ischial tuberosity. The anterior part is inserted on the ligament patellae and the distal end of femur. The posterior part is inserted on the lateral 2/3rd of the tibia. **Sacro-trochanteric** (SACTR, Fig. 9) arises from the spine of the 3rd sacral vertebra and passes in between **M. caudo-femoralis** and **M. gluteus medius**. It is inserted on the 3rd trochanter. This muscle has neither been described by Greene (1955) nor by Hill (1937). The other muscles of this group are **Mm. obturator externus** (OE, Fig. 8), **obturator internus** (OI, Fig. 8), **quadratus femoris** (QF, Figs. 8-10), **gracilis anticus** (GRA, Fig. 6), **adductor**

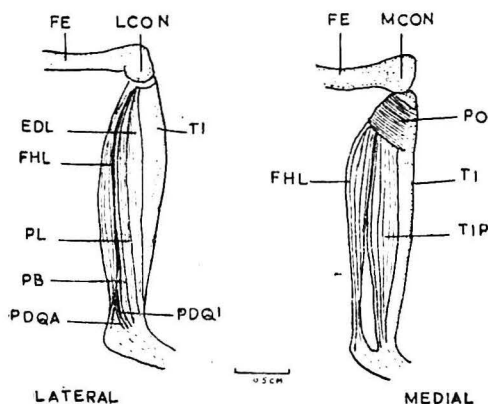


FIG 13

13. Leg musculature, -lateral and medial aspects-deep layer.

longus (ADL, Fig. 9), **adductor magnus** (ADM, Fig. 7), **adductor brevis** (ADB, Figs. 7-10), and **caudo-femoralis** (CDF, Fig. 7) which do not differ in any respect from those of albino rat.

The posterior crural muscles of the leg

The muscles of this group are Mm. **gastrocnemius** (GAL, GAM Fig. 12), **plantaris** (P, Fig. 12), **soleus** (SO, Fig. 12), **flexor hallucis longus** (FHL, Figs. 12-15), **flexor digitorum longus** (FDL, Fig. 15) and **tibialis posterior** (TIP, Fig. 12). Their attachments and origins are the same as described by Greene (1955).

The plantar muscles of the foot.

M. **flexor digitorum brevis** (FDB, Fig. 15) is a tendon of M. **plantaris** which divides into four. These parts insert on the digits 2-5. Mm. **adductor digiti quinti** (ADQI, Fig. 16), **quadratus plantae**

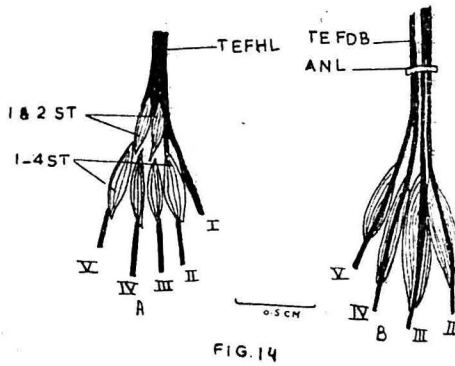


FIG. 14

14. (a) tendon of *M. flexor hallucis longus* separated from the pes showing the lumbrical muscles.

(b) Showing branches of the tendon of *M. flexor digitorum brevis*

(Q P, Fig. 15), *flexor digitorum quinti brevis* (FDQIB, Fig. 16), *flexor hallucis longus* (FHB, Fig. 16), and *adductor indicus* (ADI, Fig. 16) have the same attachments as mentioned in albino rat by Greene (1955).

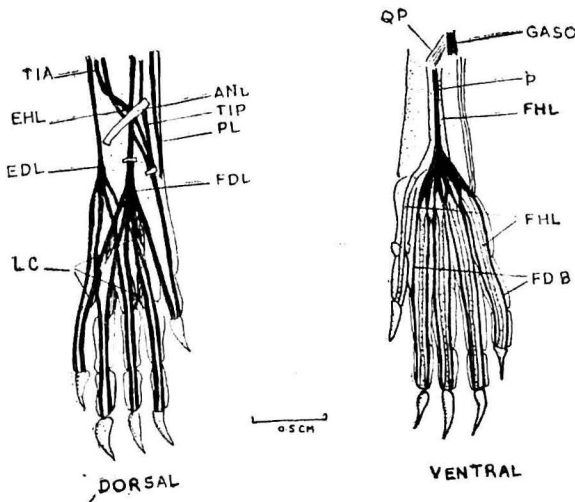


FIG 15

15. Foot musculature-dorsal and ventral aspects-showing muscles and tendon attachment.

Mm. lumbricales (LC, Fig. 15) vary in number in the different rodents. In *M. hurrianæ* there are 6 strips of this muscles. Two of these arise from the undivided part of the tendon of *M. flexor digitorum longus* and four from the tendon of this muscle. The former two strips insert on the 2nd phalanx of the digits 3-5 but the latter four insert on the base of the 1st phalanx of digits 2-5. *M. interossei plantares*

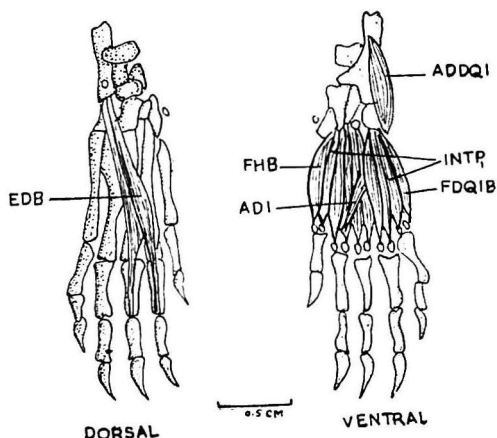


FIG 16

16. Foot musculature, dorsal and ventral aspects-after removing some tendons and muscles.

(INTP, Fig. 16) are 8 muscles in all, one each for the digits 1 and 5 and two each for the digits 2 and 4. These muscles blend with one another and give a great combined strength to the pes which is an adaptation for the digging habit.

Discussion

M. hurrianæ Jerdon is adapted to semi-fossorial and cursorial life in the arid and semi-arid regions of Rajasthan and Southern Panjab. The gerbil makes and inhabits subterranean burrows. Consequently the gerbil has much developed limbs. The gerbil uses its hind legs with great efficiency in digging. The long length of the leg provides great leverage at the acetabular joint and helps the animal in making long leaps.

Fossorial adaptations in this animal resulted in the complete fusion of the centra and the transverse processes in the sacral region. Only the first vertebra ankyloses with the anterior border of the ilium, therefore, the sacro-iliac joint is not so strong as in *Geomys* (Hill, 1937). The ilia are long and the innominate runs more or less parallel to the long axis of the body. A major portion of pubis takes part in the formation of pubic symphysis which is not-so strong as in other fossorial mammals like *Geomys* and *Thomomys* (Hill, 1937). There is no fusion of the ischium with the sacrum in contrast to that of *Geomys* where the ischium also attaches to the 5th and sometimes to the 4th sacral vertebra. These points are significant in view of its cursorial habits.

The attachment surface of the trochanters of femur is more rough than those of the other fossorial mammals like *Geomys*, *Thomomys*, *Sorex* and *Neurotrichus*. The trochanters give origin to strong muscles like Mm. gluteus maximus, vastus lateralis, adductor brevis and a new flexor muscle, sacro-trochanteric. The shaft and the neck of the femur are strong to bear the pull of strong muscles. Moreover the angle of the neck with the shaft of the femur is less obtuse so as to allow free movement of the leg.

The tibia and fibula are strongly built. Tibia is broad, strong, massive and the longest bone of this region. It gives great momentum to the animal in taking leaps. It provides more surface for the attachment of the muscles than the other bones. The muscles attached on it rotate the limb laterally and bring the pes against the wall of the burrow. It may be noted that the peroneus muscles are long and powerful. The leg is further strengthened by a partial fusion of tibia and fibula. The most striking of the fossorial adaptations of this animal are the presence of deep lateral and medial fossae, well developed medial and cranial-crests and well formed grooves at the distal end of tibia and fibula.

The extended length of the foot affords great leverage by its long posterior part of the calcaneus containing a groove through which passes the tendo-achillis of Mm. soleus and gastrocnemius for a powerful extension of the foot. The attachment of the tendons turns the normally digitigrade animal into an unguligrade while engaged in digging operation; thus aids largely in shovelling the earth. Consequently there is a reduction in the length of the lateral digits. The long

claws are dorsally convex and ventrally concave and are attached by ligaments to the digits, hence adapted for digging.

The muscles are more developed than those of the non-fossorial animals like the albino rat. *M. gluteus medius* is strong with a insertion wider than that of albino rat. *Mm. extensor digitorum longus*, *peroneus longus* *obturator externus* and *gracilis anticus* have much wider areas of origin and insertion than those of the albino rat. *M. biceps femoris* differs from that of albino rat since it has only two parts. The tendon of *M. plantaris* divides into two which later sub-divides into 4 forming the body of *M. flexor digitorum brevis* having an additional strip of muscle as compared to 3 in albino rat. The study of the myology of *M. hurrianae* reveals two extra muscles *Mm. pubo-femoralis* and *sacro-trochanteric* which have not been described in other rodents. The help given by these muscles in the movement of the femur is great, hence aid largely in digging. The presence of these two muscles is, therefore, correlated with the fossorial adaptation in this animal.

Summary

1. The osteology and the myology of *M. hurrianae* Jerdon has been studied. The functional grouping of the muscles has been adopted.
2. The pelvic girdle is not fused with the sacral vertebrae but it is firmly attached to them. The formation of acetabulum is shared 1/4th by the cotyloid, 1/2 by the ischium and 1/4 th by the ilium. The trochanters of femur, the tibia, the fibula etc. are much developed and bear rough attachment surfaces. The fossae and the crests of Tibia are developed.
3. *M. pubo-femoralis* and *sacro-trochanteric* have been observed in *M. hurrianae* for the first time. A few other muscles of this region show a different disposition than those of the non-fossorial mammals. The muscles have wider areas of origin and insertion.
4. The semi-fossorial and cursorial adaptations of the animal have been discussed.

Acknowledgments

The author wishes to thank Dr. H. L. Sharma for the useful suggestion during the work, Dr. A. K. Datta Gupta for the facilities to

work in the department of Zoology and Dr. John Hill, experimental Officer, British Museum, London for identifying the specimens of *M. hurrianæ* Jerdon. Thanks are also due to Dr. S. C. Rastogi for his help.

Literature cited.

- APPLETON, E. R. 1912 Identification of adductor muscles of the thigh of mammals. *Proc. Anat. Soc. Great Britain and Ireland*.
- 1928 The muscles and the nerves of the post-axial region of the tetrapod thigh. *Jour. Anat.* 62:364.
- BLANFORD, W. T. 1888 The fauna of British India-Mammals, London
- CHAWORTH, J. L. Musters
- and ELLERMAN, J. R. 1947 A revision of genus *Meriones*. *Proc. Zool. Soc. London*. 177 (1) :478-504.
- ELLERMAN, J. R. 1947 Notes on some rodents in the British Museum. *Proc. Zool. Soc. London*. 117: (1) 259-271.
- GREENE, E. C. 1955 The anatomy of the rat. Hafne publ. Co. Trans. Ameri. Phil. Soc. New series-27: 1-370.
- HAINES R. W. 1934 The homologies of the flexor and adductor muscles of thigh. *Jour. Morph.* 56: 21-49.
- HILL, J. E. 1937 Morphology of the pocket gopher, mammalian genus *Thomomys* *Uni. Calif. Publ. Zool.* 42:81-172
- HOWELL, A. B. 1926 Anatomy of the wood rat. Comparative of the subgenera of the american wood rat (Genus *Neotoma*). *Monog Amer. Soc. Mamm.* 1:1-225, frontal piece, 2 plts, 33 figs. in the text and 4 tables.
- JERDON, T. C. 1867 The Mammals of India, London
- MURRAY, James A. 1884 The vertebrate Zoology of Sind.
- PARSON, F. G. 1892 Some points in the myology of rodents. *Jour. Anat. Physio.* 26.
- REED, C. A. 1951 Locomotion and appendicular anatomy in three soricoid insectivores. *Amer. Midl. Nat.* 45: 513-671.

SHARMA, D. R. 1958 Studies on the anatomy of the Indian Insectivore, *Suncus murinus*. Jour. Morph. 102 (2): 427-554.

KEY TO THE LETTERING

ACE, acetabulum; ACEB, acetabular border; ACENT acetabular notch; ADB adductor brevis; ADQL adductor digiti quinti; ADI, adductor indicus; ADL, adductor longus; ADM, adductor magnus; ANARPR, anterior articular process of sacrum; ANL, annular ligament; ANPU, angle of Pubis, ARP, ascending ramus of pubis; BCF1 & BCF2, biceps femoris anterior and posterior; C, calcaneus; C1, C2, C3, cuneiform 1-3; CAUFO, caudal fossa; CD, cuboid; CDF, caudo-femoralis; COT, cotyloid bone; CRCRE, cranial crest; DI, diaphysis; DRP, descending ramus of pubis; EDB, extensor digitorum brevis; EDL, extensor digitorum longus, EHL, extensor hallucis longus; EPL, epiphyseal line; FDB, flexor digitorum brevis; FDL, flexor digitorum longus; FDQIB, flexor digiti quinti brevis; FE, femur, FHB flexor hallucis brevis; FHL, flexor hallucis longus; FI, fibula; FRV, ventral foramen FUTF, fused portion of tibia and fibula, GAL, gastrocnemius lateral, GAM, gastrocnemius medial, GLA, gluteus maximus, GLE, gluteus medius, GLI, gluteus minimus, GR, gracilis, GRA, gracilis anticus, GRP, gracilis pesticus, GRTS, spine of greater trochanter, GTR, greater trochanter, HD, head, IL, ilium, IL, iliacus, ILCRE, iliac crest, ILR, iliac ridge, INCRE, interosseus crest, INTP interossei plantares, ISC, ischium, IVSP, inferior ventral spine IC, lumbricales, LCON, lateral condyle, LETR, lesser trochanter, LFO, lateral fossa, LMA, lateral malleolus, MCON, medial condyle, MCRE, medial crest, MMA, medial malleolus, MT, metacarpal N, navicular, NC, neck, OE, obturator externus, OF, obturator foramen, OI, obturator internus, P, plantaris, PAP, posterior articular process, PB, peroneus brevis, PC, pectineus, PDQA, peroneus digiti quinti, PF, piriformis, PH, Phalanx, PL, peroneus longus, PM, psoas major, PMA, psoas minor, Po, popliteus POFO, popliteal fossa, PSMT, insertion of semitendinosus accessory, PT, patella, PTGR, patellar groove, PUB, pubis, PUFIE, pubo-femoralis, PUS, pubic symphysis, QF, quadratus femoris, QL, quadratus lumborum, QP, quadratus plantae, RF, rectus femoris, RISC, ramus of ischium, S, sesamoid, SAC, sacrum, SACTR, sacro-trochanteric, SCNT, sciatic notch, SMM, semi-membranosus, SMTI, semi-tendinosus

principal, SMT2, semi-tendinosus accessory, SO, soleus, ST, strip of muscle, SVSP, superior ventral spine, TA, talus TEFDB, tendon of flexor digitorum brevis, TEFHL, tendon of flexor hallucis longus, TFL, tensor faciae latae, TI, tibia, TL, tibiale, TIA, tibialis anticus, TIP, tibialis posticus, TISC, tuberosity of ischium, TR3, 3rd trochanter, TR3S, spine of third trochanter, TRCR, trochanteric crest, VL, vastus intermedialis, VL, vastus lateralis, VM, vastus medialis.

"THE HISTOLOGY AND THE PROBABLE FUNCTIONS OF THE SKIN IN THE HEDGEHOG, P.M. MICROPUS BLYTH."

B. B. Gupta

(Now at Faculty of Agriculture, Dayanand College, Ajmer.)

Department of Zoology

Birla College, Pilani

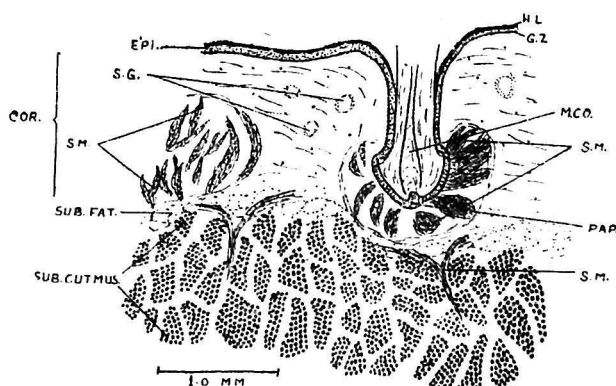
There exists very little literature on the Erinacoids, and especially on the histology of the different organs. During the investigation on the rolling mechanism in the hedgehogs, it was noted that apart from other muscles, the **superficial cutaneous** (**Musculus cutaneous** or formerly known as the **Panniculus carnosus**) plays an important role in this phenomenon. To find out the exact nature and relationship of this muscle to the skin a histological study of the skin along with the muscle was found necessary. The absence or atypical disposition of the sebaceous glands in the adult skin led the author to study the skin of the neonatal one also. The skin was fixed in Bouin's fluid and sections of 8 μ were cut.

The skin of the hedgehog is typically mammalian; the hair are present on the skin of the ventral surface and the spines on the dorsal surface. These spines histologically are similar to the hair and are in fact modified hair. In a longitudinal section the presence of the spine capsule and the spine papilla at the base disclose the homology to the hair capsule and hair papilla.

The skin consists of the epidermis, the dermis and the subcutaneous fat layer. In the dorsal region of the body there is an additional muscular layer beneath the fat layer.

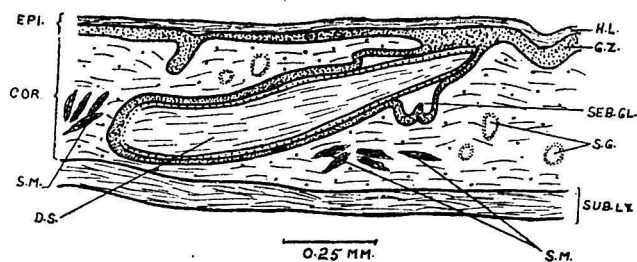
The epidermis is the outermost layer and is penetrated by the hair or spine as the case may be. This layer is composed of stratified squamous epithelium and is differentiated into the two sub-layers, the outer horny zone and the inner germinative zone. The horny zone consists of clear granular and horny cell layers, and its thickness varies from region to region. It is very thin in the skin of the dorsal surface and is better developed in the skin of the undersurface of the manus and pes. The germinative zone is thicker than the horny zone and consists of basal and prickle cell layers. It continues into the dermis by the sides of the spines or hair to form their sheath

The dermis is a thick layer containing the sweat and sebaceous glands and the hair or spine follicles, apart from the blood vessels and the nerves. It consists of felted connective tissue in which some thin unstriated muscle bundles are also present.



(Figure 1)

T.S. of the skin of adult *P. m. micropus* passing through the spine and superficial cutaneous muscle.



(Figure 2)

T. S. of the skin of young one of *P. m. micropus* passing longitudinally through the spine.

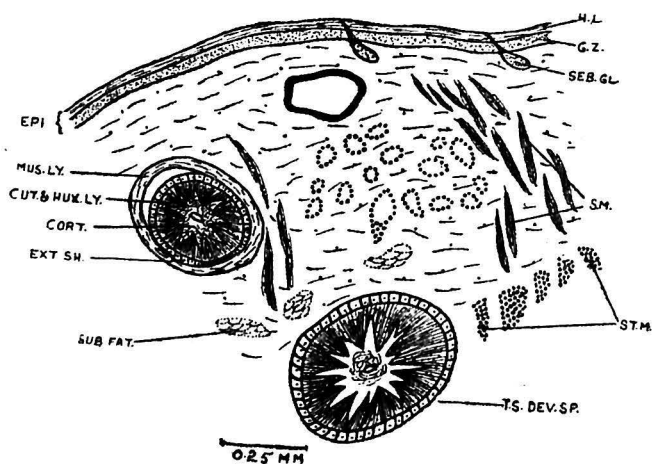


Fig. 3

T. S. of skin of young one of *P. m. micropus* passing transversely through the spine.

COR. Corium, CORT. Cortical layer of the spine, COT & HUX LY. Cuticle and Huxley's layer T. S. DEV. SP. Transverse section of developing spine DS. Developing spine EPI. Epidermis, EXT. SH. External sheath, GZ. Germinative zone H. L. Horny layer, M. Co. Medullary core, MUS. LY. Muscular layer, PAP. Papilla, S. G. Sweat gland, S. M. Smooth muscle, SEB. GL. Sebaceous gland, ST. M. Striped muscle, SUB. FAT. Subcutaneous fat, SUB. LY. Subcutaneous layer, SUP. CUT. MUS. Superficial cutaneous muscle.

The spines, as already said, project from the skin of the dorsal surface of the animal. The section of the spine (Figs. 1 and 3) presents a central core, the medulla, surrounded by the horny layer, the cortex. The spine is enclosed in a cellular sheath continuous with the germinative layer of the epidermis. The sebaceous glands are absent or if present, they are at the base of the capsule and are probably non-functional. The shaft of the spine narrows down as it passes through the epidermis and the dermis, but soon bulges out and forms a bulb-like structure at the base, the spinal capsule. This broad conical base of the spine lies inside a big muscular cone (Fig. 2). The base of the spine is covered by the germinative layer of epidermis and the bands of smooth muscle run from the base of the spine to the surface of the outer cone. At the base of the spine is a small papilla of the germinative layer, on which rests the spine, similar to the hair papilla.

In the dermis, the cut ends of vessels and the sweat glands are well marked. Some of the sweat glands even open directly at the surface. The presence of the smooth muscular bands in the dermis (Fig. 1) point to the partly involuntary nature of the rolling mechanism of these animals.

Under the dermis lies the subcutaneous fat layer. This layer is not very prominent in the skin of the dorsal surface because at this region there is a thick ventral muscular layer and on account of this, the fat is deposited mostly ventrally to it.

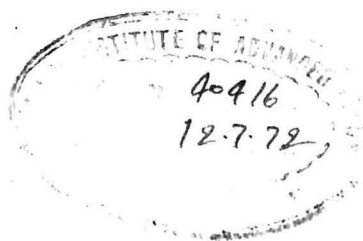
The section of the dorsal skin shows a thick muscular layer under the subcutaneous fat layer. This muscular layer is in close connection with the skin. The presence of the thin smooth muscular bands in the form of strips running between the striated superficial cutaneous muscle and the dermis of the skin further points to the close

relation of the skin with the superficial cutaneous muscle (Fig. 1). The approach of the smooth muscle strips to the spines suggests the relationship of the cutaneous muscle and their co-ordination in the rolling of the animal and the erection of the spines.

The skin of the neonatal one (Figs. 2 and 3) though fundamentally similar to that of the adult just described, shows some modifications which point to a phylogenetic relationship. The spines remain embedded in the dermis and only small posteriorly directed tubercle like projections are marked at the surface. The spines during development come out by the sides of the tubercles. The epidermis has a comparatively thin horny layer. Some sweat glands also open into the sheath of the spine. The spine capsule is not well developed and similarly the smooth muscles of the capsule are lacking. The subcutaneous fat layer is thin.

SUMMARY

In the young, the spines remain embedded in the dermis. The dermis is comparatively thick, especially in the skin of the dorsal region where it has to support the spines. Histologically the structure of the spine is similar to that of the hair, and can be regarded as modified hair. The presence of the sebaceous glands in the neonatal and their movement down to the spinal base thereby becoming nonfunctional may mean their vestigial nature in the adult. The presence of a thick muscular layer beneath the skin of the dorsal surface and its connection with the dermis of the skin through unstriated muscular strips suggest the close relation of the cutaneous muscles with the skin and the importance of the two in the rolling of the hedgehog. The striated nature of the cutaneous muscles associated with smooth muscles leads one to infer that rolling in hedgehogs may be voluntary. At least the straightening of the spines in the rolled up specimen is involuntary.



V Medicine:

1. Dr. S. C. Mehta, Principal, Bikaner Medical College, Bikaner.
2. Dr. R. M. Kasliwal, Principal, S.M.S. Medical College, Jaipur.
3. Dr. G. L. Talwar, Professor of Surgery, S. M. S. Medical College, Jaipur.
4. Dr. Y. Appaji, Professor, Bikaner Medical College, Bikaner.
5. Dr. D. K. Santra, Prof. of Pharmacy, Birla College of Science, Pilani.
6. Dr. Shoorvir Singh.
7. Dr. L. M. Sanghvi, S.M.S. Medical College, Jaipur.

(General Editor).

VI Education:

1. Shri R. K. Kaul, Principal, Government Teachers' Training College, Ajmer.
2. Shri B. G. Tiwari, Principal, Government Teachers' Training College, Bikaner.
3. Shri P. L. Shrimali, Principal, Vidya Bhawan, Gobindram Teachers' College, Udaipur.

(General Editor).

VII Engineering:

1. Shri V. Lakshminarayanan, Principal, Birla Engineering College, Pilani.
2. Shri V. G. Garde, Principal, M. B. M. Engineering College, Jodhpur.
3. Shri R. M. Advani, Professor, M. B. M. Engineering College, Jodhpur. (General Editor).

VIII Law:

1. Dr. R. N. Varma, Reader, University Law College, Jaipur.
2. Shri M.L. Sawney, Professor of Law, Dungar College, Bikaner.
3. Shri A. Nataraj, Professor of Law, M. B. College, Udaipur.
4. Shri S.C. Thanvi, Professor of Law, Jaswant College, Jodhpur.
5. Dr. G. S. Sharma, Principal, University Law College, Jaipur. (General Editor).

IX Commerce:

1. Shri N. M. Kothari, Professor of Commerce, S. D. Govt. College, Beawar.
2. Shri G. L. Joshi, Professor, Dayanand College, Ajmer.
3. Shri K. K. Mehrishi, Professor, Commerce College, Jaipur.
4. Shri C. B. Mamoria, Professor of Commerce, M. B. College, Udaipur.
5. Shri B. D. Bhargava, Principal, Commerce College, Jaipur.
6. Dr. R. G. Sarien, Professor of Commerce, Government College, Ajmer. (General Editor).