VERTEBRATE PEST CONTROL PROJECT.

FOOD SECURITY MANAGEMENT

POST-HARVEST MANAGEMENT

COOPERATIVE RESEARCH STUDIES

ON

BIOLOGY , POPULATION DYNAMICS, ECONOMIC

IMPORTANCE AND CONTROL OF VERTEBRATE PESTS

ANNUAL REPORT

OCTOBER 1, 1989 - DECEMBER 31, 1990

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INTRODUCTION

This report covers the period extending from October 1,1989 through December, 1990 during which researches on the following topics were carried out:

1. Distribution,density and economic importance of house rats in village and farm houses.
2. Population density, reproduction and diet of house rats in Faisalabad City.
3. Breeding success of the rose-ringed parakeet in some subhabitates of the agroecosystem in central Punjab.
4. Development of methods for estimating the relative densities of porcupine populations.
5. Assessment of sparrow(Passer species) damage to cereal crops in central Punjab.
6. Development of rodent control strategies in an experimental area under a wheat-sugarcane-fodder cropping pattern.

The results of these studies have been briefly documented in this report. Studies on porcupine and house sparrow shall continue the next year, that is, January 1,1991 through December 1991 alongwith the following studies:

1. Development of methods for estimating the relative densities of porcupine populations.

2. Assessment of sparrow(passer species) damage to cereal crops in central Punjab.

3. Development of rodent control strategies in an experimental area under a wheat-sugarcane-fodder cropping pattern.

4. Control of rats and mice in farm houses.

5. Studies on flock composition, flock formation, foraging and feeding habits sparrows (passer species) in central Punjab.

We and particularly the postgraduate students who had/have been the main beneficieries of this Cooperative Research Project are indebted to Mr.Joe.E.Brooks(Team Leader) and Mr. Ijaz Ahmad(Programme Specialist) for their cooperation in providing logistic, computer and equipment facilities as well as for their guidance and moral support. We are confident that the quality of our research work will greatly improved as we learn to put the computers to more productive and meaningful uses.

DR. MIRZA AZHAR BEG
Principal Investigator

DR. AKBAR ALI KHAN
Co-Principal Investigator.

PROJECT TITLE: Distribution, density and economic importance of the house rat in village and farm houses.

STUDENT:

Name: Muhammad Mushtaq-ul-Hassan

Degree: Ph.D.

INTRODUCTION:

House rats (Rattus rattus) infest human dwellings, shops and grain markets in towns and cities all over Pakistan and cause considerable damage to all kinds of food stuffs. In rural areas too house rats are important indoor pests. Information about the rural population of house rat in Pakistan seems to be lacking. It would be interesting to know about the abundance, population structure, reproductive biology and economic importance of the house rats and other indoor small mammals infesting different types of structures in village and farm houses of central Punjab.

OBJECTIVES:

1. Estimate the size of rodent populations living in various rural structures.

2. Know about population structures and reproductive biology of rodents infesting the rural structures.

3. Obtain an estimate of stored grains and other food stuffs lost to the house rat.

ACCOMPLISHMENTS:

Each year, during the period extending from July, 1987 through June, 1990, 111 rural structures (63 house, 14 shops, 8 flour mills, 25 farm houses and one poultry farm) from 12 different localities in central Punjab were sampled for the house rat and other small mammals. Each month several of the structures mentioned above were sampled at a given locality using 90 snap traps (60 rat and 30 mouse traps) for five successive nights. Tracking tile data (percent tiles with food prints) was obtained for the nights immediately preceding and immediately following each of the monthly trapping sessions. The captured specimens were brought to the laboratory and were weighed and measured before being autopsied.

During the 36 months of trapping, 2030 small mammals were captured in 16200 trap nights. The trapped

samples comprised of about 72.81% Rattus rattus, 13.99% Mus musculus , 6.7% Tatera indica, 0.05% Bandicota bengalensis, and 6.5% Suncus murinus (Table 1). The proportion of the house rat in the farm houses was 63.2%, whereas in structures placed under the village complex its proportion ranged from 69.3% to 76.1%. Surprising by the proportion of the house mouse in the sample from the farm houses was low (6.8%) as compared to 16.7% to 20.2% of the structures of the village complex. In the poultry farm, the house rat had absolute numerical dominance as it constituted 97.0% of the trapped sample. A few mice (3.0%) were present in the poultry farm sample. T. indica regularly visited the farm houses and were only rarely caught from some of the village houses. The house shrew consistently occurred in all the structure types except the poultry farm from where it was not recorded.

The trap success of the house rat in the farm houses, village houses, and village shops ranged between 8.0% to 9.9% (Table 2). In the flour mills it was low (6.2%) but about two times larger in the flour mill.

Table 1. Species composition of small mammals in the samples collected from different rural structures from July,1987 through June,1990.

Structure type	Percent (No. animals captured)										Total	
	R. rattus		M.musculus		T. indica		B. bengalensis		S.munirus			
Farm houses	63.17	(343)	6.81	(37)	21.92	(119)	0.18	(1)	7.92	(43)	26.75	(543)
Village complex	75.42	(071)	17.25	(245)	1.13	(16)	-	-	6.27	(89)	70.00	(1421
Village houses	76.07	(852)	16.70	(187)	1.34	(15)	-	-	5.89	(66)	55.17	(1120
Village shops	74.18	(158)	20.19	(43)	-	-	-	-	5.63	(12)	10.49	(213)
Flour mills	69.32	(61)	17.05	(15)	1.14	(1)	-	-	12.50	(11)	4.33	(88)
Poultry farm	96.97	(64)	3.03	(2)	-	-	-	-	-	-	3.25	(66)
Total	71.81	(1478)	13.99	(284)	6.65	(135)	0.05	(1)	6.50	(132)	2030	

Table 2. Trap success of small mammals collected from different rural structures from July,1987 through June,1990.

Structure Type	Percent trap success (No. animals captured)										Total	
	R.rattus		M.musculus		T.indica		B.bengalensis		S.munirus			
Farm houses	8.02	(343)	0.86	(37)	2.78	(119)	0.02	(1)	1.01	(43)	12.70	(543)
Village complex	9.30	(1071)	2.13	(245)	0.14	(16)	-	-	0.77	(89)	12.34	(1421)
Village houses	9.86	(852)	2.16	(187)	0.17	(15)	-	-	0.76	(66)	12.96	(1120)
Village shops	8·36	(158)	2.28	(43)	-	-	-	-	0.63	(12)	11.27	(213)
Flour mills	6.16	(61)	1.52	(15)	0.10	(1)	-	-	1.11	(11)	8.89	(88)
Poultry farm	15 .80	(64)	0.49	(2)	-	-	-	-	-	-	16.30	(66)
Total	9.12	(1478)	1.75	(284)	0.83	(135)	0.01	(1)	0.81	(132)	12.53	(2030)

In terms of species diversity, the farm houses were faunistially most diverse, the village houses and flour mills less diverse, the village shops were even lesser diverse while the poultry farm fauna was the least diverse.

Population density estimates for the house rat and the small mammals(including the house rat) were obtained from the tracking tile data using change-in-ratio (CIR) method and from the removal data using linear regression of cumulative captures on daily captures (LR) (Table 3). An average farm house, village house and village shop harboured 5 to 6 house rats. There was an average of three rats in the flour mills. Population size of the house rat for the poultry farm could not be computed due to some irregularity in the trapping data. However, it was possible to estimate the population size of small mammals for this structure. Of the 27 (CIR) and 33 (LR) animals that lived in the poultry farm, 26 to 32 should have the house rats (see Tables 1 and 3).

The male house rats were found to be reproductively active throughout the year (Fig. 1).

Table 3. Estimates of population density for small mammals structures in rural areas of central Punjab.

Structure type	Per unit density		
	R. rattus	All species	
	LR	LR	CIR
Farm houses	5	9	9
Village complex	5	7	7
Village houses	6	7	7
Village shops	5	7	7
Flour mills	3	4	5
Poultry farm	-	33	26
Combined	6	8	8

Fig. 1 Breeding activity in monthly samples of male R. rattus captured from farm and village complexes during July, 1987 through June, 1990.

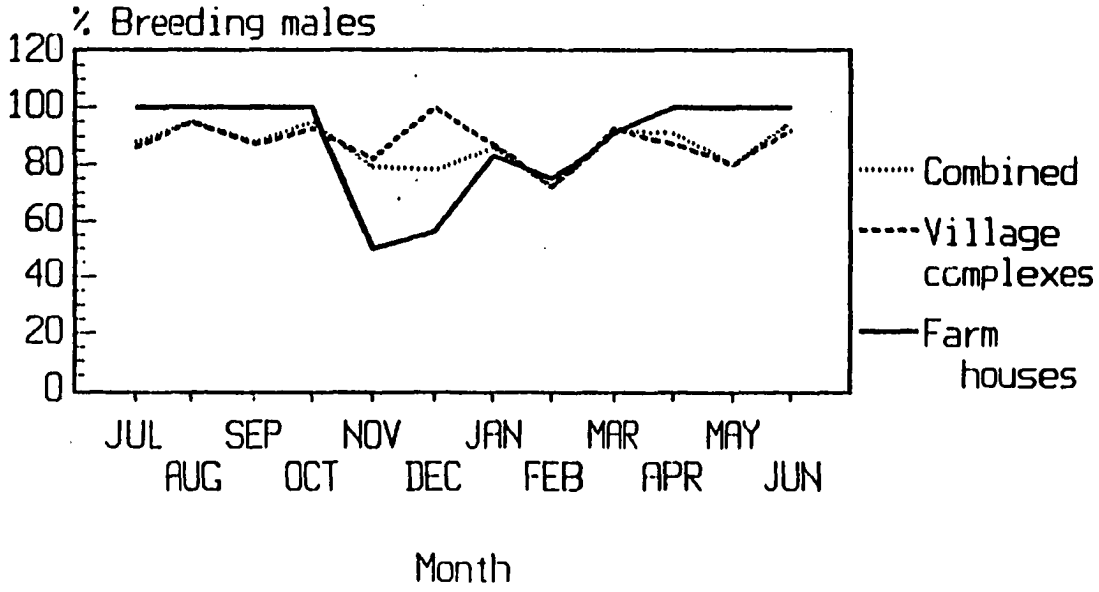
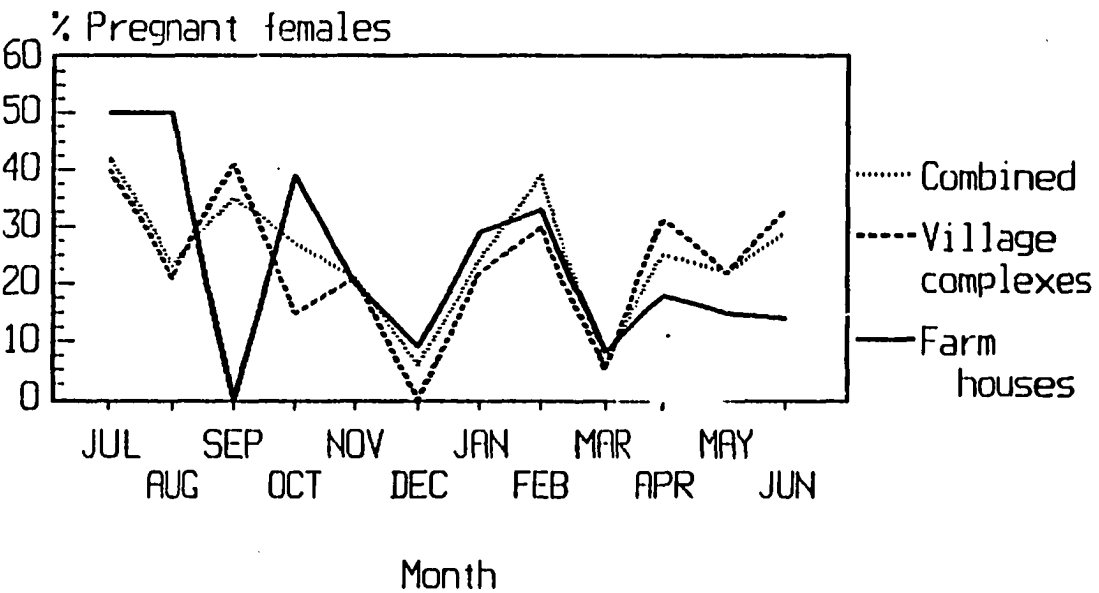


Fig. 2 Breeding activity in monthly samples of female R. rattus captured from farm and village complexes during July, 1987 through June, 1990.



Pregnant females were generally present in all the monthly samples. High prevalence of pregnancy was recorded from July through October and once again in January and February. Low pregnancy peaks were recorded in the months of December and March which roughly followed high peaks (Fig. 2).

PROJECT TITLE: Population density and reproduction of the house rat(*Rattus rattus*) in groceries and sweet shops of Faisalabad city.

STUDENT:

Student: Anwaar Ahmad Khan.

Degree: M.Sc.

INTRODUCTION:

The house or roof rat (*Rattus rattus*)is an indoor commensal of man in Pakistan. It is found both in urban and rural areas throughout Pakistan. Apart from being a pest of stored grains and other food stuffs, it is a vector of a number of human diseases. The present study is a part of a larger study which is aimed at knowing the population density and other demographic attributes of the rat population in different types of indoor environments.

OBJECTIVES:

The specific objectives of this study are as follows;

1. To estimate population density of Rattus rattus in sweet shops and grocer's shops.

2. To define and describe the reproductive parameters of the rat population oassociated with the above two structures.

ACCOMPLISHMENTS:

During the period extending from June,1989 through May, 1990, a total of 15 grocer's shops and 14 sweet shops was sampled for the house rat (Rattus rattus). The sampling consisted of snap trapping which lasted for five consecutive nights each month. Inked tracking tiles were placed immediately before and after each trapping period to know the activity of small mammals. In 1425 trap nights, a total of 218 rats was captured from the grocer's shops and the average trap success for the entire study period was 15.3%. In the monthly samples, the trap success varied from 2.5% in August, 1989 to 35.8% in June,1989.

From sweet shops 92 house rats were trapped in 1380 trap nights. The average trap success for the

entire study period was 6.7%. In the monthly samples the trap success ranged from 2.5% in December, 1989 and May,1990 to 14.2% in April, 1990.

In the samples of small mammals from the grocer's shops, the proportion of the house rat was 96%, of Mus musculus 3%, and total of Suncus murinus 1%.

Estimates for the house rat population was obtained both by the change - in - ratio (CIR) and linear regression (LR) method. The average number of house rat per grocer's shop was estimated to be 33 by CIR method and 25 by LR method; the number of rats per meter square area of the shops was 0.662 and 0.502 (Table 1). The average number of rats per sweet shop was estimated to be 14 by CIR method and 7 by LR method. The number of rats per meter square of the shops was 0.401 and 0.201(Fig. 1 to 4).

The mean body weight of the males in the sample from the grocer's shops was 91.8 ± 45.8 (S.D.) g

Table-1: Estimates of number of house rat in average grocer's shops in Faisalabad.

Season	Av.No.of rats per shop		
	No.captured	CIR	Lin.Reg.
Summer	18	25	48
Autumn	14	37	-
Winter	8	18	10
Spring	17	68	34
Combined/Average	15	33	25

FIG.1 ESTIMATES OF RAT NUMBER PER UNIT AREA OF THE GROCER'S SHOPS.

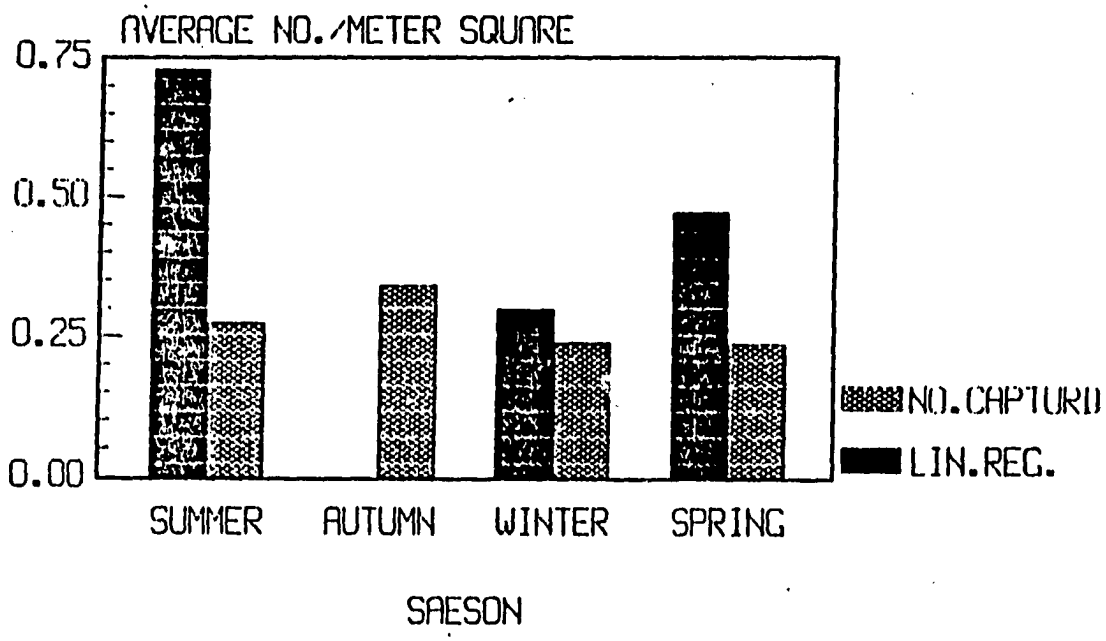


FIG.2 ESTIMATES OF RAT NUMBER PER UNIT AREA OF THE SWEET SHOPS.

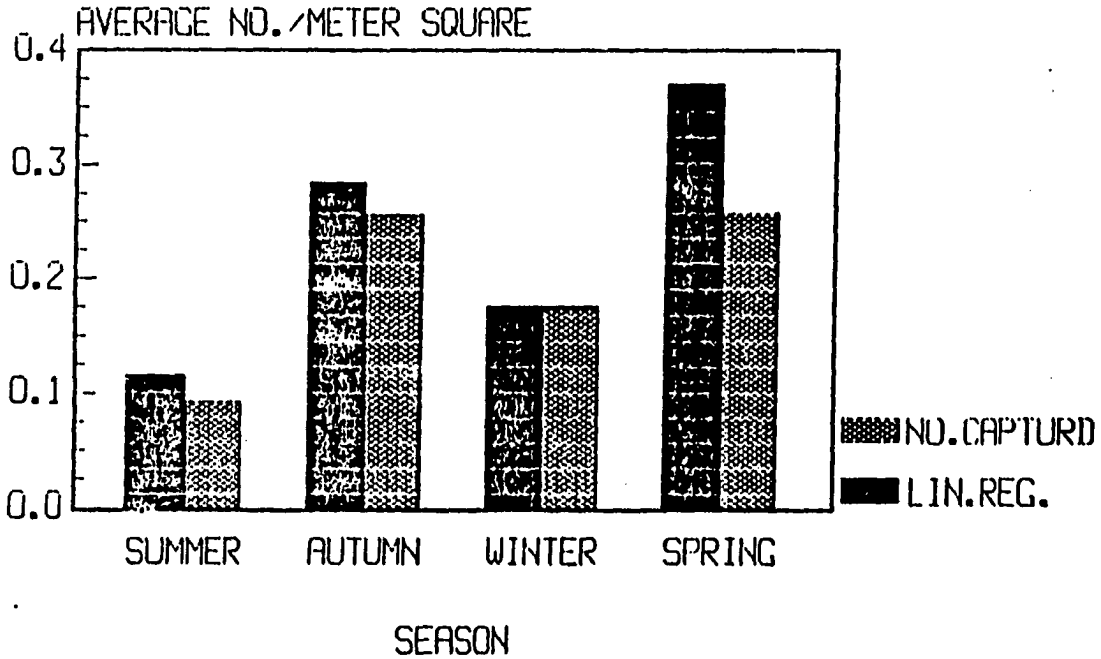


FIG.3 ESTIMATES OF RAT NUMBER PER UNIT AREA OF THE GROCER'S SHOPS.

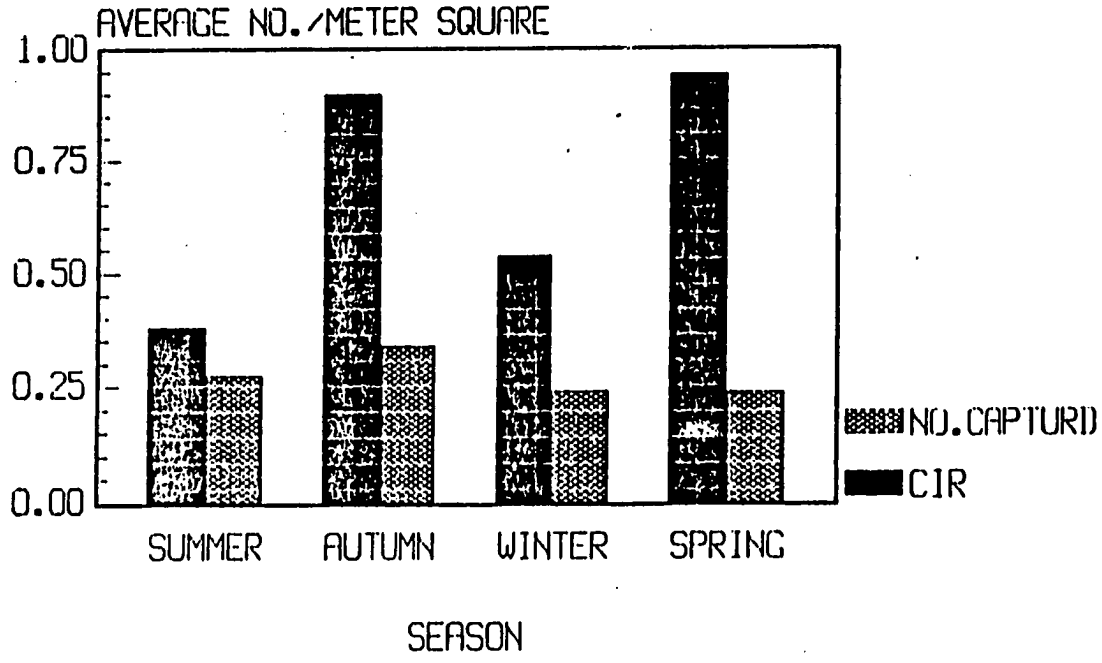
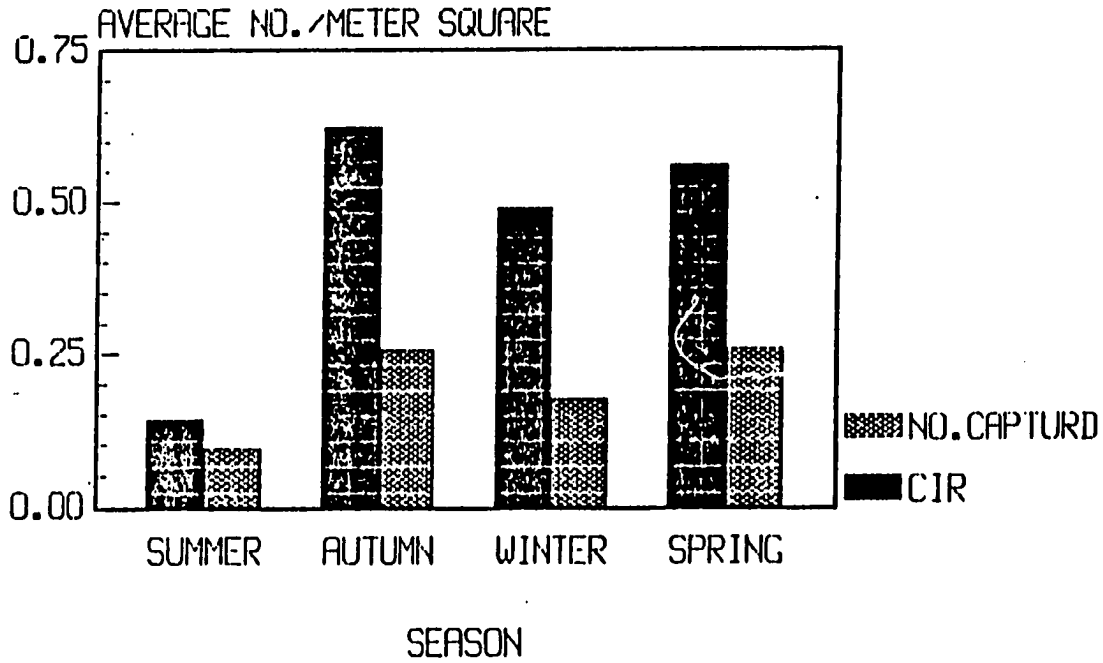


FIG.4 ESTIMATES OF RAT NUMBER PER UNIT AREA OF THE SWEET SHOPS.



and of the females 89.6 ± 45.5 (S.D.) g, and the mean head and body length (HBL) for males and females was respectively 154.3 ± 28.2 (S.D.) mm and 151.9 ± 29.1 (S.D.) The mean body weight for the males and females from the sweet shops was 105.4 ± 48.9 (S.D.) g and 92.4 ± 44.4 (S.D.)g and the mean HBL's were 156± 33.9 (S.D.) mm and 153.7 ± 29.8 (S.D.) mm, respectively.

The mean house rats from the both structures having body weight 98 gm or more and HBL 166 mm or more were considered as sexually mature. The females weighing 92 g or more having HBL 166 mm or more were designated as sexually mature.

The sex ratio in the samples from the grocer's as well as sweet shops was 1:1.5 in favour of the females. During all the four seasons of the year, both the males and females were found to be reproductively active. The prevalance of pregancy in the female rats of the grocer's shops and sweet shops averaged 41% and 64%, respectively. The average embryonic litter size for grocer's shops was 6.8 ± 2.3(S.D) mm

and for sweet shops 6.9 ± 2.3 (S.D) mm (Table 2).

Immature rats constituted 48% of the total sample taken from the grocer's shops and 49% from the sweet shops.

Table-2 :Litter size in relation to embryo size(in utero) in female house rat (Rattus rattus)of the grocer's shops and sweet shops of Faisalabad City.

Embryo Size(mm)	Grocer's shops		Sweet shops		Combined	
	No.Preg. females	Litter size Mean±S.D.	No.Preg. females	Litter size Mean±S.D.	No.Preg. females	Litter size Mean±S.D.
4-13	11	8.0 ± 1.8	11	7.1 ± 2.6	22	7.5 ± 2.2
14-23	7	6.6 ± 2.1	4	5.5 ± 1.9	11	6.2 ± 2.0
⩾ 24	4	3.8 ± 0.9	3	8.3 ± 0.6	7	5.7 ± 2.6
Total/Average	22	6.8 ± 2.3	18	6.9 ± 2.3	40	6.9 ± 2.3

PROJECT TITLE: Population density and reproduction in house rat (Rattus rattus) living in residential houses and grain shops of Faisalabad city.

STUDENT:

Name: Anwer Ali

Degree: M.Sc.

INTRODUCTION:

Because of its wide distribution, high abundance, and dependence on man for food and shelter, and its food plundering and polluting habits, the house rat (Rattus rattus) is probably most important among all the mammalian prests found in Pakistan. The rat is fairly common in both rural and urban areas of central Punjab where besides being a pest of food stuffs it is a vector of a number of human diseases of which murine typhus and jaundice are locally important.

OBJECTIVES:

1. To estimate the size of house rat population affecting residential houses and grain shops in Faisalabad city.

2. To define and describe some reproductive parameters of the rat infesting the houses and grain shops.

ACCOMPLISHMENTS:

Population size and some reproductive parameters of the house rat (Rattus rattus) living in the lower middle class residential houses, and grain shops of Faisalabad city were estimated. During the period extending from June,1989 through May, 1990, 22 residential houses and 12 grain shops of the new grain market of Faisalabad were sampled for the rat using snap traps. Each month, the trapping period lasted for five successive nights. The small-mammal activity indices were obtained with inked tracking tiles each month just before and after the five nights of removal trappings.

A total of 175 house rats was captured in 1,680 trap nights from the residential houses. The average trap success was 10.4%. In the monthly samples, the trap success ranged from 6.7% each in August and December,1989 to 16.3% in November, 1989 (Fig. 1).

In the grain shops, 161 house rats were captured in 1,455 trap nights and the average trap success

FIG.1 SEASONAL TRAP SUCCESS OF HOUSE RAT (R.rattus) IN THE RESIDENTIAL HOUSES IN FAISALABAD CITY.

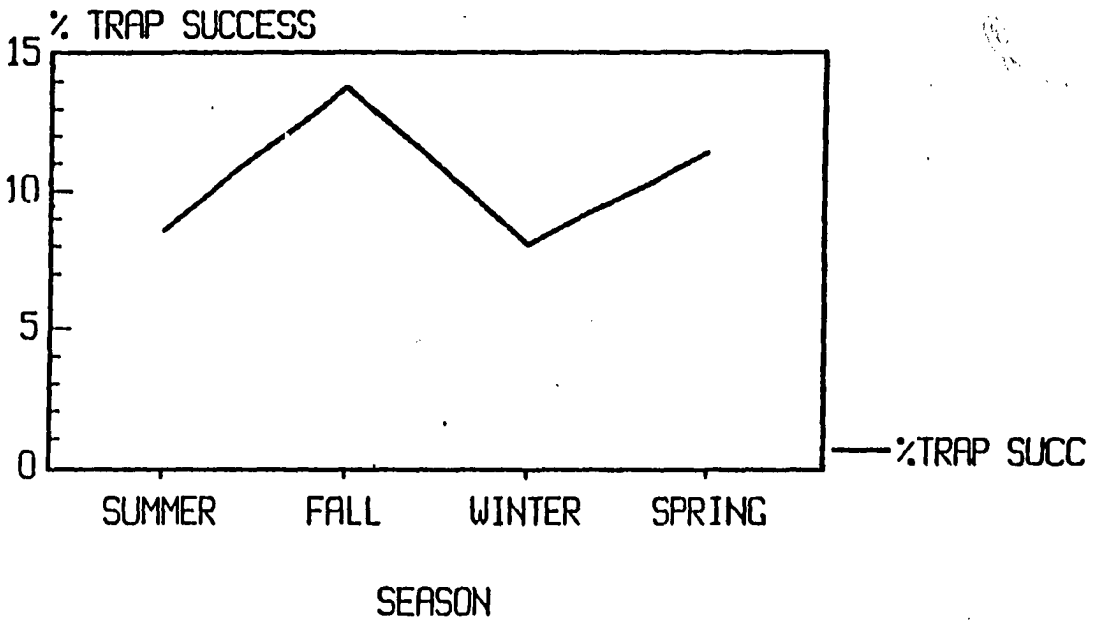
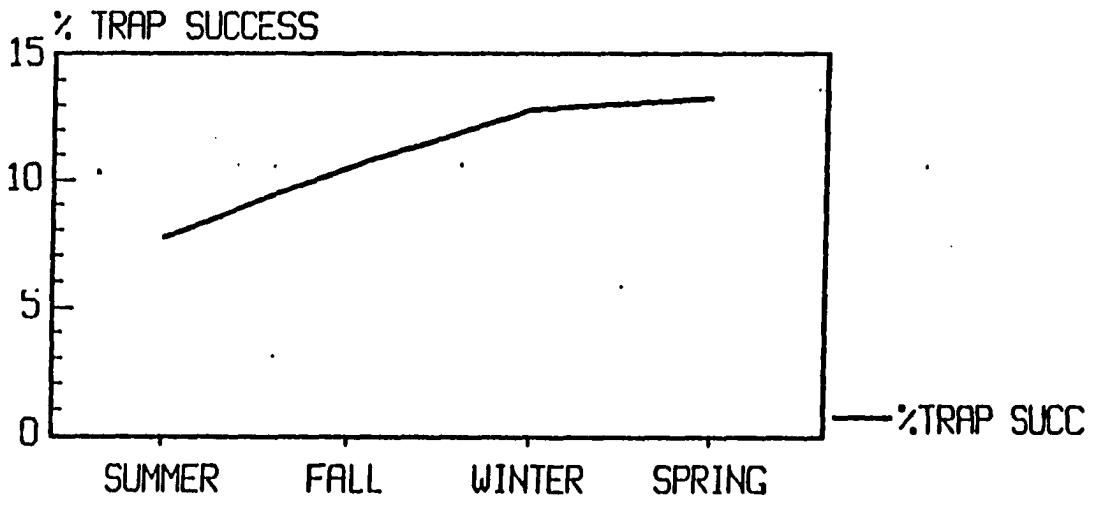


FIG.2 SEASONAL TRAP SUCCESS OF HOUSE RAT (R.rattus) IN THE GRAIN SHOPS IN FAISALABAD CITY.



was 11.1%. The trap success in the monthly samples ranged from 3.3% in August (1989) to 23.3% in April (1990) (Fig.2).

In the trapped sample from residential houses, the proportion of the house rat was 75.4% of Mus musculus 23.7% and that of Suncus murinus 0.9%. In the grain shops, the rat was more dominant as it constituted 95.8% of the sample, whereas Mus musculus, and Suncus murinus constituted only 1.2% and 3.0%, respectively.

Population size estimates for the house rat were derived from the change - in - ratio (CIR) method as well as by the linear regression of cumulative captures on daily (LR). In the residential houses, the average number of rats per house was estimated by CIR method to be 14 and by LR method 11 (Fig. 3). The respective densities rats per meter square of the floor surface were 0.130 and 0.104.

The average number of rats per grain shop was estimated by CIR method to be 25 and 17 by LR method (Fig. 4). The respective densities of rats per meter square

FIG.3 SEASONAL ESTIMATES OF POPULATION SIZE OF HOUSE RAT (R.rattus) IN THE RESIDENTIAL HOUSES.

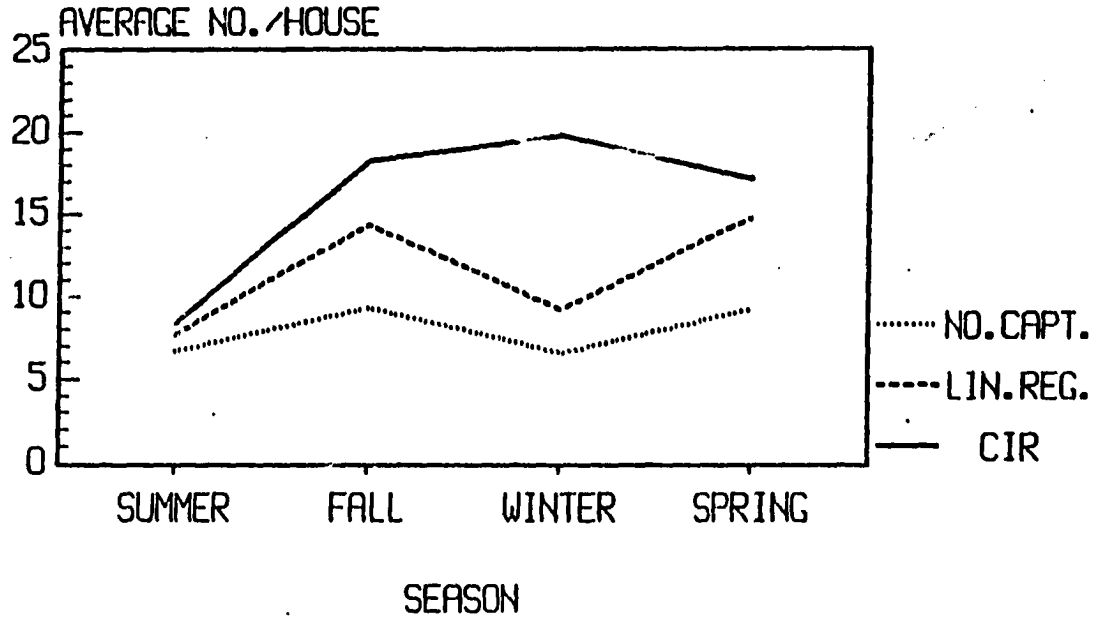
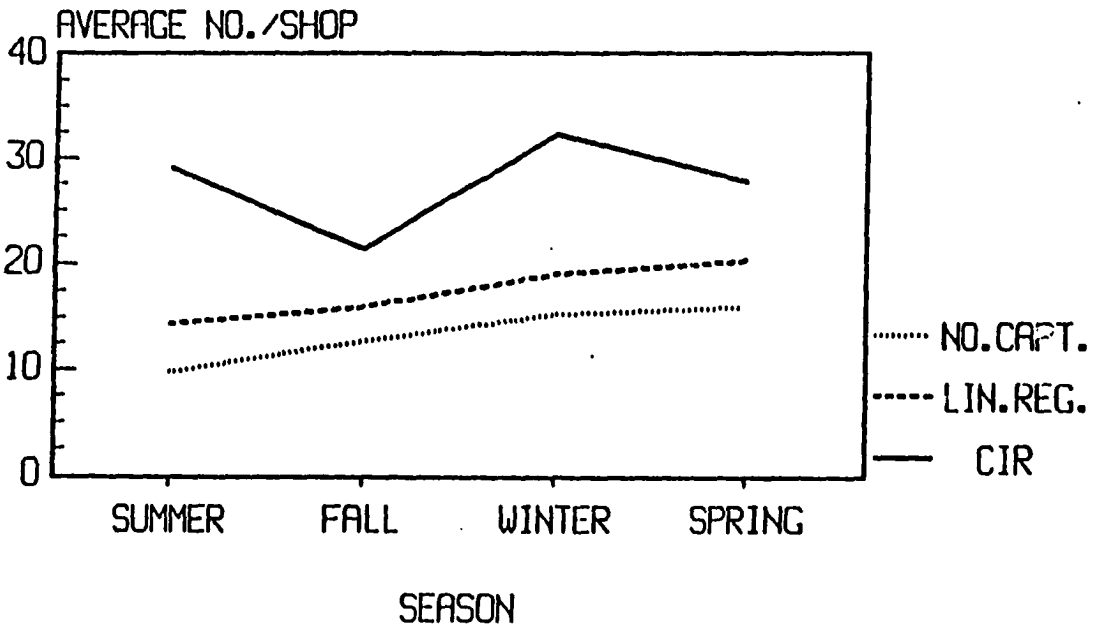


FIG.4 SEASONAL ESTIMATES OF POPULATION SIZE OF HOUSE RAT (R.rattus) IN THE GRAIN SHOPS.



were 0.297 and 0.208.

The mean body weight for the male and female rats from the residential houses was 93.7 ± 48.4 (S.D.) g and 75. 9 ± 42.6 (S.D.) g and the mean head and body lengths (HBL) were respectively 154.6 ± 31.1 (S.D.) mm and 143.8 ± 28.7 (S.D.) mm. The mean body weight for the male and females from the grain shops was 88.8 ± 44.7 (S.D.) g and 99.1 ± 47.3 (S.D.) g and the mean HBLS were 150.8 ± 25.7 (S.D.) mm and 156.8 ± 27.8 (S.D.) mm, respectively.

More than 50% of the males from the two structures were found to be sexually mature when they weighed 82 g or more in body weight and measured 143 mm or more in HBL. More than 50% of the females were sexually mature when they had attained a body weight of 70 g or more and a HBL of 139 mm or more. All such males and females were defined as mature adults.

The ratio of the two sexes in the samples from residential houses and grain shops approximated the

theoratical 1:1 ratio. Both the sexes were found to be reproductively active during all the four seasons of the year. The prevalence of pregnancy in the female rats from the residential houses and grain shops averaged 34.1% and 34.6% , respectively (Table 1). The average litter size for residential houses was 6.3 $\pm$ 1.8 (S.D.) and for the grain shops it was 6.6 $\pm$ 2.0 (S.D.) (Table 2). Immature rats constituted 44% of the total sample from the residential houses and 40% of the sample from the grain shops.

Table- 1 Seasonal variations in the prevalence of pregnancy in adult female house rats living in some residential houses and grain shops of Faisalabad City.

Season	Residential houses			Grain shops			Combined		
	No. obs.	No. preg.	% preg.	No. obs.	No. preg.	% preg.	No. obs.	No. preg.	% preg.
Summer, 1989	9	4	44.4	9	2	22.2	18	6	33.3
Fall, 1989	10	3	30.0	10	1	10.0	20	4	20.0
Winter, 1989 - 1990	8	4	50.0	13	4	30.8	21	8	38.1
Spring, 1990	14	3	21.4	20	11	55.0	34	14	41.2
Total/Av.	41	14	34.1	52	18	34.6	93	32	34.4

Table- 2 Litter size in relation to embryo size (in utero) in *Rattus rattus* of the residential houses and grain shops of Faisalabad City.

Embryo size Classes (mm)	Residential houses		Grain shops		Combined	
	No. preg. females	Litter size Mean ± SD	No. preg. females	Litter size Mean ± SD	No.preg. females	Litter size Mean ± SD
2 - 9	8	6.3 ± 1.5	7	5.7 ± 1.4	15	6.0 ± 1.4
10 -17	6	6.8 ± 2.1	4	6.5 ± 2.6	10	6.7 ± 2.2
18 -25	1	4.0 +	5	7.8 ± 2.4	6	7.2 ± 2.6
26 -33	-	-	2	6.5 ± 0.7	2	6.5 ± 0.7
Total	15	6.3 ± 1.8	18	6.6 ± 2.0	33	6.5 ± 1.9

PROJECT TITLE: Breeding success in thr rose-ringed Parakeet in central Punjab.

STUDENT:

Name: Muhammad Inam

Degree: M.Phil.

INTRODUCTION:

The rose-ringed Parakeet(Psittacula krameri) is a serious pest of agriculture in Pakistan. Although it depredates on a variety of food crops including pulses, cereals and oil seed crops, yet sunflower, brassica and corn are the principal targets of its attack. No orchard fruits is safe from the attacks of this avian pest; in central Punjab, guavas, mangoes, dates and cirtus fruits are ruthlessly plundered.

During 1987-88 two studies, both sponsored under the present Cooperative Research Studies Programme, investigated the food and foraging habits, distribution and density of nests, reproduction, and breeding behaviour of the parakeets. Scaring value of the reflection tape

against the parakeets in sunflower fields was also assessed.

The studies on reproduction revealed that only 35% of the breeding pairs were able to fledge their young. Such a low fledging success motivated the present study which is aimed at knowing that factor(s) contributing to rate of reproduction in the parakeet.

OBJECTIVES:

1. Reassess reproductive success in the parakeet.

2. Know the factor(s) inhibiting reproductive sussess in the parakeet.

ACCOMPLISHMENTS:

This study on the Rose-ringed Parakeet (Psittacula krameri) was carried out from March, 1989 through July, 1990 on the campus of University of Agriculture (Faisalabad) . A total of 233.5 man hrs. was spent for recording the field observations. Some results of these observations are presented in this report.

Eighty nest cavities possessed by parakeets or defended by them for any length of time were located on a part of the old campus of the University. These cavities were regularly visited and any Parakeet or Myna activity that related to them was recorded. The Parakeets began occupying nest cavities by October and relenquished them by June. Maximum number of cavities were used by the Parakeets as nests in February, March and April. A Comparison of 1989 and 1990 data shows that in 1990 the Parakeets began breeding about the month earlier than in 1989 (Fig. 1). The Common Myna began occupying the nest by March (1990) or May (1989) and bred till August with a peak in June and July. However, all the eighty cavities were never utilized as nests neighter by the Parakeets alone nor by Parakeets and Myna jointly. It does not however, imply that the cavities not in uses of any of these two species were necessarily unoccupied. At least four of these cavities were known to be used by the Spotted Owlet. Other potential candidates for such tree cavities are Wood peckers, Indian Roller, Palm Squrriel, and Monitor Lizard.

Fig 1. Percent nest cavities occupied by Rosed-ringed Parakeet and other birds.

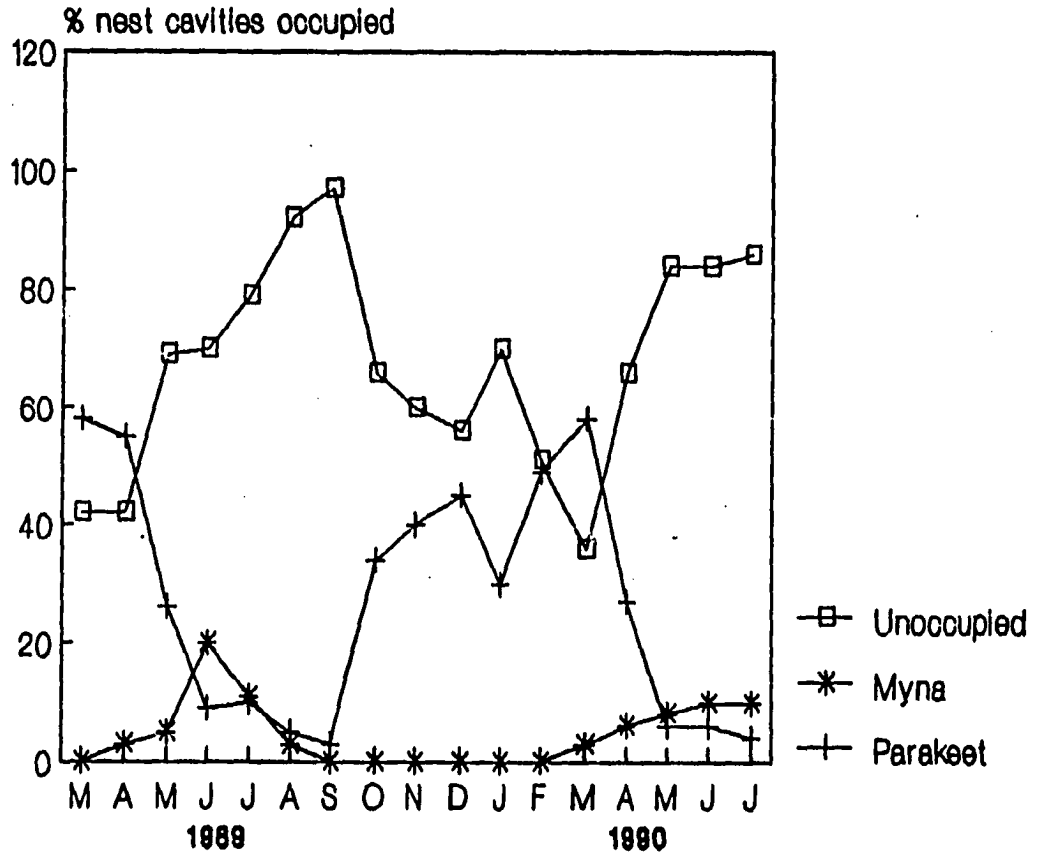


Table 1. Breeding success in the Rose-ringed Parakeet.

Year	No.of nests appeared to be occupied	% Incubating (n)	% Hatching (n)	% Fledged (n)
1989	80	73 (58)	72 (42)	45 (19)
1990	80	76 (61)	82 (50)	42 (21)
	80	75 (60)	77 (46)	43 (20)

Fig 2.Number of intra- and inter-species squabbles per hour of the total observation time.

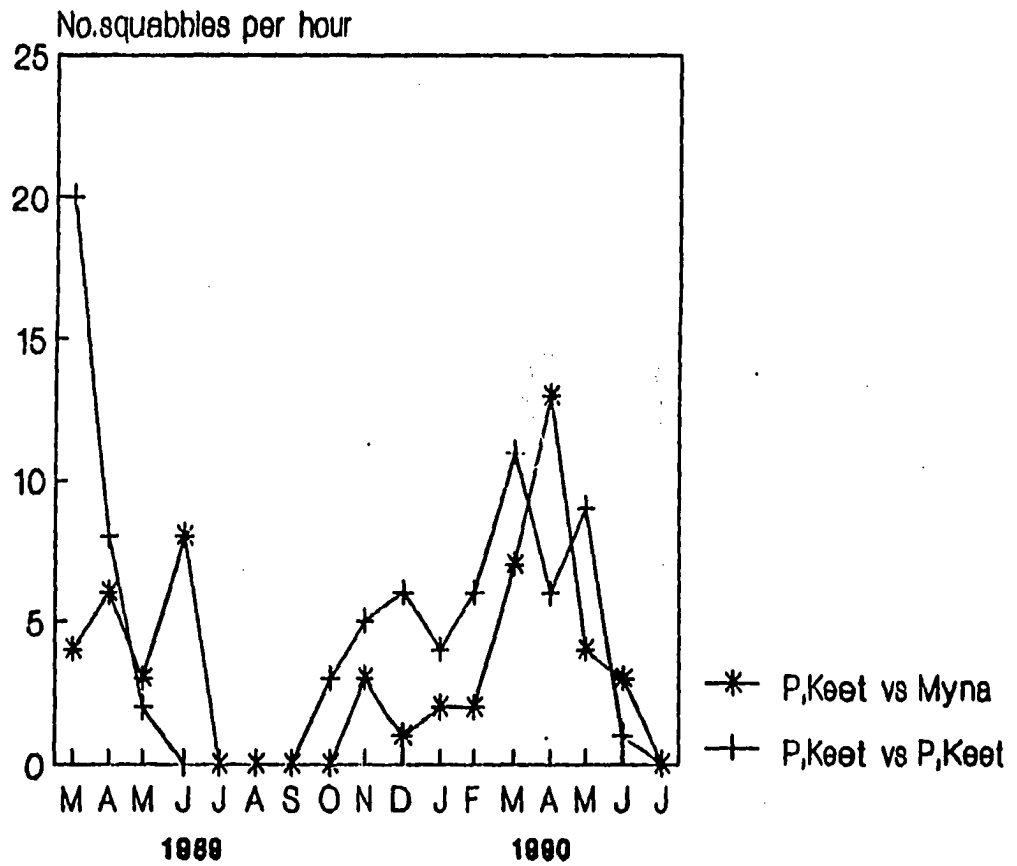


Table 2. Foods of the Rose-ringed Parakeets consumed during the breeding season.

	Food								
		1989	1990	1989	1990	1989	1990	1989	1990
1.	Arjan (Terminatia arjuna)	C	C	C	R	R	-	-	-
2.	Banyan (Fiscus bengalensis)	I	C	C	C	-	-	-	-
3.	Ber (Zizyphus Spp.)	I	I	C	-	-	-	-	-
4.	Date Palm (Phoenix dactylifera)	-	-	-	-	-	-	C	R
5.	Gul-e-Nishter (Erythrina saberoza)	I	I	I	I	-	-	-	-
6.	Maize(Zia mays)	-	-	C	C	I	I	I	C
..	Mulberry(Morus Spp)	I	I	I	I	-	-	-	-
8.	Simble (Salmalia melabarica)	C	C	-	-	-	-	-	-
9.	Siris(Slbezzia Spp.)	C	C	C	R	-	-	-	-
10.	Sunflower (Helianthus annuus)	-	-	I	I	I	I	I	I
11.	Wheat (Triticum aestivum)	C	C	C	R	I	C	I	I

R = Rarely
C = Commony
I = Intensively

The Parakeets began squabbling over the possession of the next cavities with their own kinds right from October through May with a peak in March (Fig. 2). The Common Myna fought over the next cavities with Parakeet from November through June.

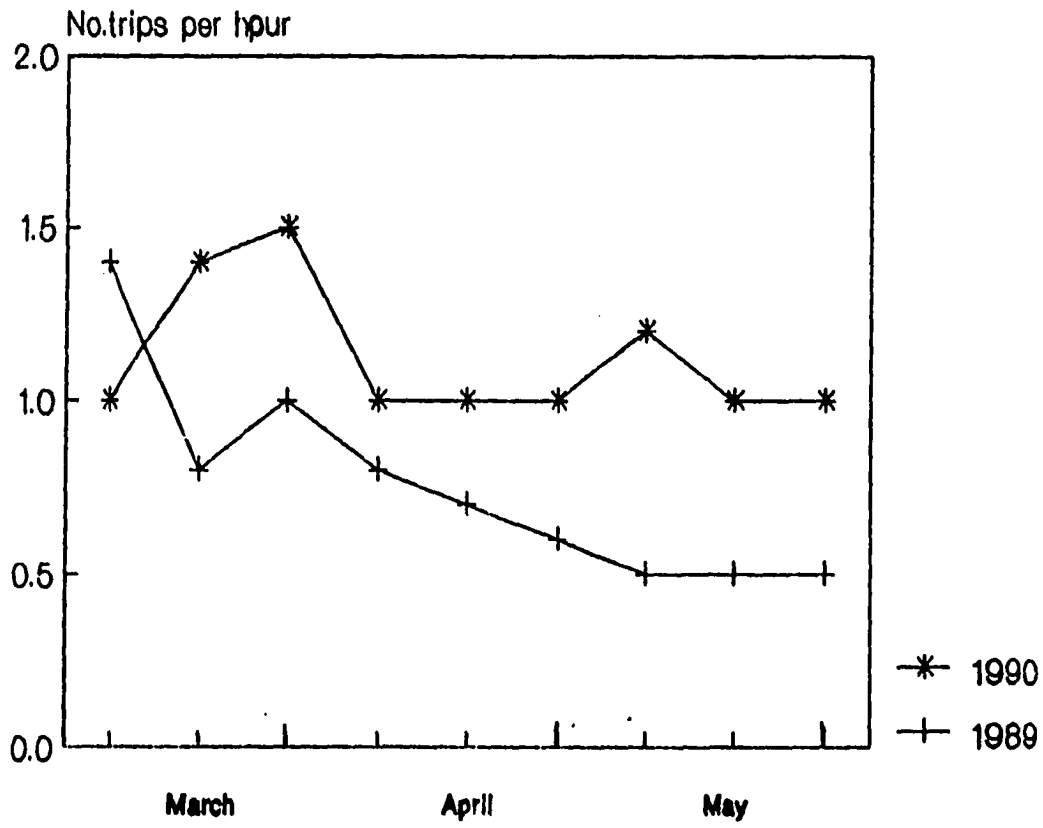
Of a total of 80 cavities 60(75%) were were positively occupied and used by the parakeet as nests as egg laying took place in the cavities (Table 1). In 46 (77%) of 60 nests hatching took place and from only 20 (43%) nests nestlings were observed to fledge. To the natural factors which tend to decreasing the fledging rate in the Parakeet, we may include the people who steal nestlings about to be fledged and keep or sell them as pest birds.

Table 2 lists the food the breeding males bring for the brooding females. It may be mentioned here that the University Campus is a roosting as well as a breeding site to the Parakeets. In fact, almost all roosting sites of the Parakeets are excellent breeding

sites too. But, by no means the Parakeets do not nest outside the roosts. Rather constrained by paucity of nesting sites they attempt to exploit all nesting sites and particularly those which also promise easy access to food. The University Campus happens to be one of many such breeding sites. Fruits and flowers of ornamental plants and the nearby fields of crops ensure consistent and easy supply of food.

The males have been noted bringing food for the brooding females at the rate of 0.5 to 2.0 times per hour. Fig. 3 depicts average number of hourly visits (for 10-days durations) the males make during the breeding season to keep the females and their nestling, properly fed. Intuitively, farther, the food source is located from the nest the greater will be the cost of successfully completing the process of reproduction.

Fig 3.Number trips made by breeding male parakeet to feed incubating/brooding females.



PROJECT TITLE: Relative density and control of Indian crested porcupine (*Hystrix indica*) in central Punjab.

STUDENT: Muhammad Siddique, M.Phil. degree programme.
Faqir Muhammad, M.Sc. degree programme.

INTRODUCTION:

Before the massive development of canal irrigation in Punjab at the turn of the present century, the Indian crested porcupine (*Hystrix indica*) inhabited the tropical thorn forest. The carrying capacity of the region (which was formerly vegetated with the thorn forest) has been sustantially raised by the introduction of canal irrigated agriculture. Recent studies on the distribution and abundance of porcupine burrows show that the porcupine largely resides in the embankments of drainage canals and forest plantations. From these sites, they regularly visit the nearby farms in the course of their nocturnal foraging trips and cause extensive damage to maize, potato, sweet potato, and sugarcane. These agricultural crops as well as the plantation trees that are detbarked must be protected against the porcupine. In order to achieve this end we

need to have an ecologically acceptable method for inhibiting the porcupine population as well as a method for monitoring trends in its population following a reduction programme.

OBJECTIVES:

1. Standarize food station transect method with respect to porcupine so that seasonal and annual trends in its relative density could be known.

2. Co-relate the estimates of relative density with the density of active porcupine burrow systems.

3. Develop a method for reducing the porcupine population by using a toxicant(s) and monitor the population following removal.

ACCOMPLISHMENTS:

Four transects, two along a drainage canal near Chakku Forest, Jaranawala and two in a forest plantation near Lalian, near Rubwah, began operating from February (1990) and March (1990), respectively. A third transect was added to each of the two localities in April and May respectively. All six transects consisted of 10 bait stations each. Bait stations, were placed at about 100 m intervals. The transects were run for four consecutive

nights on bimonthly basis from February /March through November. The drainage canal transects could not be run during the months of August and October whereas the forest plantation transects remained inoperable during the month of September due to some student problem on the University Campus.

There was a total of 440 operable station nights for the three drainage canal (DC) transects during which there were 216 known porcupine visits for an index of 49 and a visit rate of approximately one porcupine per 9.0 active stations (Table 1).

The DC-1 transect had the highest porcupine visitation. Out of 160 operable station nights, 106 porcupine visits were recorded for an index of 60 and a visit rate of one porcupine per 1.5 active stations. For DC-2 and DC-3 transects index values were 32 and 49 and visit rates were 3.1 and 2.0 active Stations per porcupine visit.

The forest plantation (FP) transects had much lower porcupine visitation (Table 1). Of a total of

Table 1. Total index values for each transect for the porcupine for the month of February through November, 1990.

Transect		No. Operable Station Nights	Total visit	Index* value
Drainage Canal				
	1	160	106	66
	2	120	59	49
	3	160	51	32
Total	440	440	216	49
Forest Plantation				
	1	149	38	26
	2	150	49	33
	3	110	34	31
Total		409	121	30

* Index of Relative Abundance =

$$\frac{\text{Total Porcupine Visits}}{\text{Total Operable Station Nights}} \times 100$$

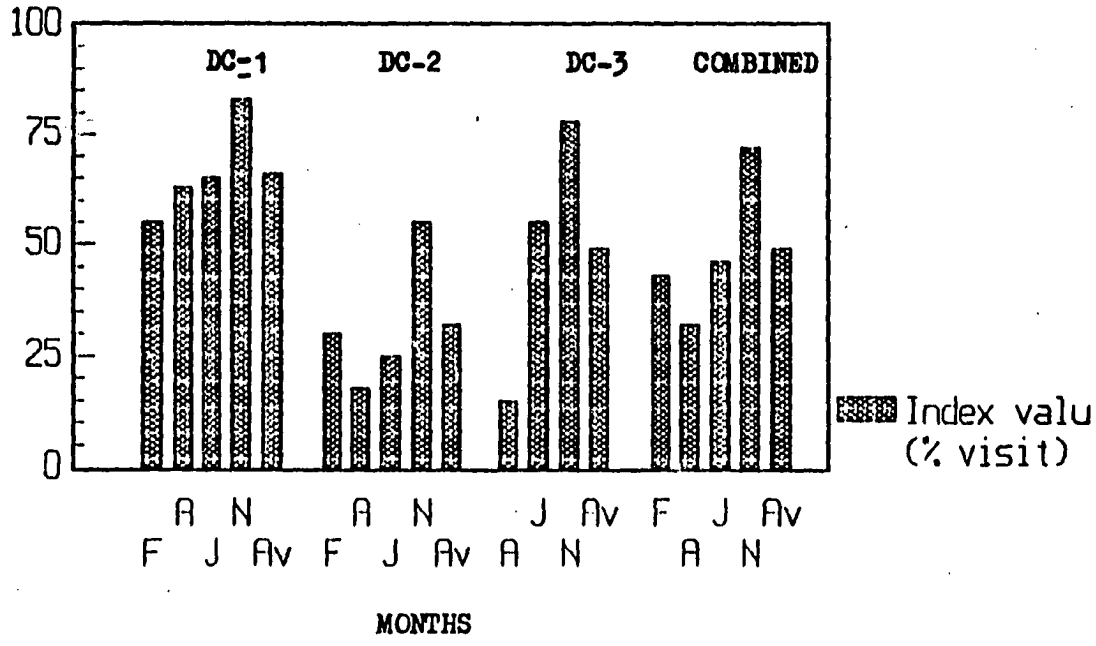
440 operable station nights, 31 were rendered inoperable by rain, cattle, or dogs. The number of operable station nights actually obtained was 409. During the 409 operable nights there were 121 known porcupine visits for an index of 30 and visit rate was 3.4 active stations per porcupine visit.

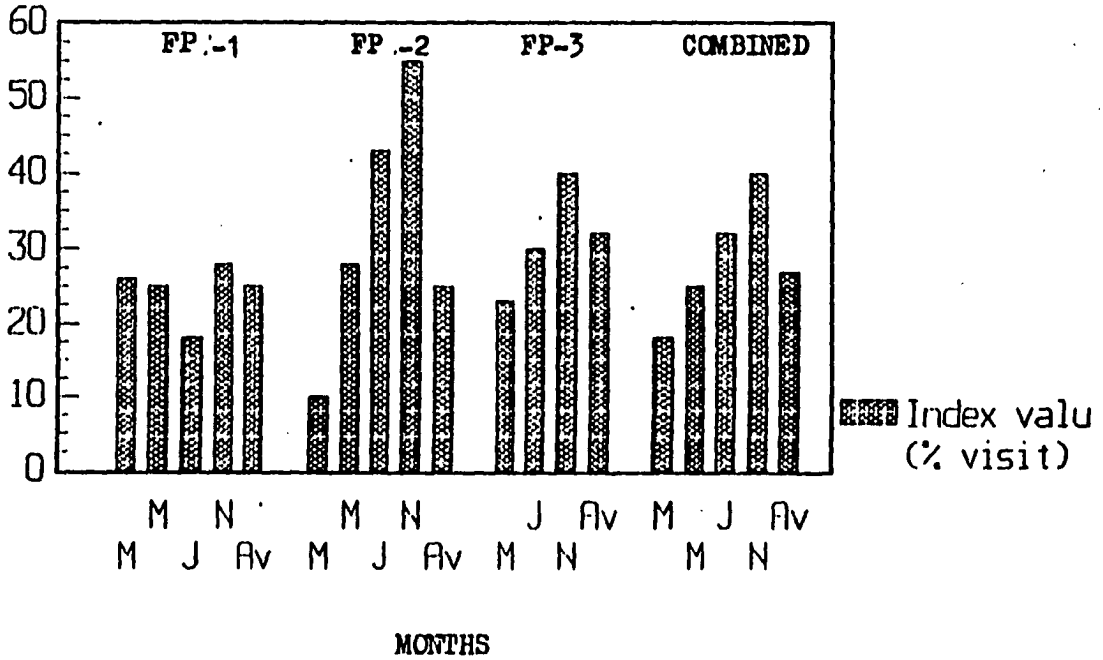
The FP transects were relatively less variable than those of DC transects with respect to their index values and visit rates. FP-1 transect had an index of 26, FP-2 33, and FP-3 31 and the respective visit rates were 3.9, 3.0, and 3.2 stations per porcupine visit. The obvious reason for high index of values for the DC transects was perhaps the presence of larger number of porcupine burrows in the vicinity of these transects.

Bimonthly Bait Station Results.

Fig. 1 present bimonthly indices of relative abundance for the porcupine for DC and FP transects. One pattern, in both the tables, which catches the eye is almost a consistent increase in the index values as the

Fig 1.Bimonthly indices of relative abundance for the porcupine for the Drainage Canal(DC)and Forest Plantation (FP) transects.





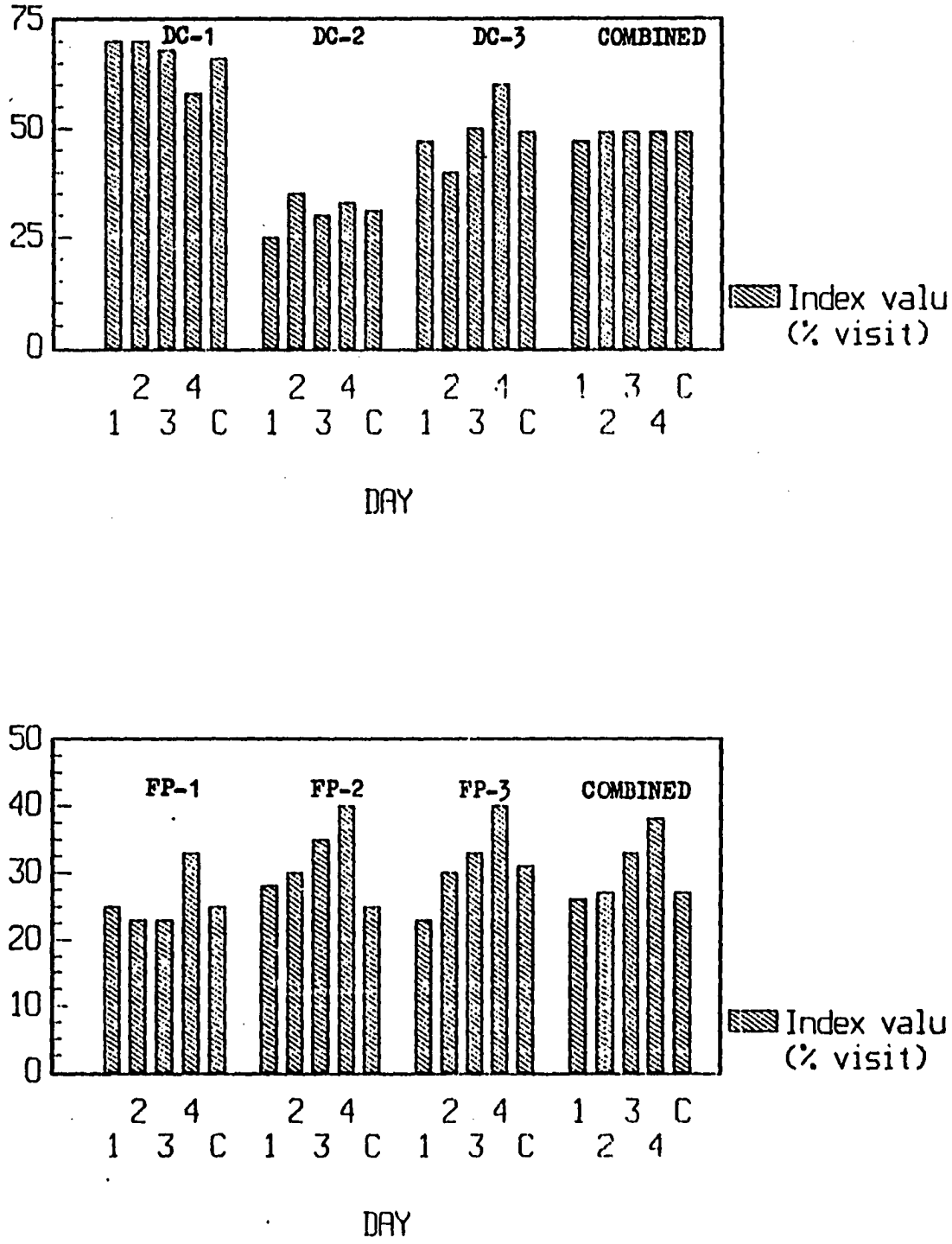
bimonthly sampling progressed. The highest porcupine index values were recorded in November. This indicates towards some behavioural or demographic changes in the porcupine population.

One Night Versus Four Nights of Operation.

In the case of DC-1 transect the average index value on the first night was 70, 70 on the second night, 68 on the third night, and 58 on the fourth night (Fig. 2). In the case of transect DC-2, the average index values were 25, 35, 30, and 33 for the first, second, third and fourth nights of baitings. For transect DC-3 the values were 47, 40, 50, and 60 . However, the averages of the three transects for each of the four nights varied very little among themselves.

In transect FP-1 index value on the first three nights varied very little. On the fourth night, however, it increased by about 8% over that of the first night. In the remaining two transects the index value increased progressively. On the fourth night, the index

Fig 2. Visits of active bait stations by day of transect operation by porcupine for the Drainage Canal(DC) and Forest Plantation(FP) transect.



value was 12% larger in the case of the transect FP-2 and 17% larger in the case of transect FP-3 than those of the respective first night values. The averages of the three transects showed a progressive increase from the first to the fourth night; there being a difference of 12% between the indices of the first and four nights. So the porcupine activities in the DC and FP transects were different perhaps this difference was related to distribution of porcupine burrow in the proximity of the transects; DC transect had many porcupine burrows in their immediate vicinities.

PROJECT TITLE: House sparrow damage to cereal crops in central Punjab.

STUDENT:

Name: Muhammad Ubaidullah and Shafique-ur-Rehman

Degree: M.Phil.

INTRODUCTION:

The house sparrow (Passer domesticus indicus) is a hangeron of man in Pakistan. The sparrow largely nests inside buildings and feeds on cultivated cereals, seeds of weeds and grasses. At the time of maturation and ripening of the wheat and rice crops, the bird forms large flocks and is said to inflicts heavy damage on these crops. The Spanish sparrow (Passer hispaniolensis), which is believed to pass through central Punjab in the fall and spring seasons, joins the local sparrow population in depredating the rice and wheat crops.

The house sparrow is considered to be a serious pest of cereal crops in Pakistan. Its status as pest needs to be defined. To achieve this objective, its

depredatory activities and food habits will be studied in detail.

OBJECTIVES:

1. Assess sparrows damage to wheat and rice crops.
2. Analyse the crop contents of sparrows to know about their food habits.
3. Assess the role of migratory forms of sparrows in depredating the cereal crops.

ACCOMPLISHMENTS:

House sparrow damage to the wheat and rice crops in central Punjab was estimated in April and November (1990), respectively. All the major roads connecting Faisalabad and Kamalia cities with other cities/towns of Punjab were the sites of the present survey. At each of these roads, twenty points at 1 km distance were selected and assigned a nuique number. A radom selection of 3 to 6 of these points were then made and each of the selected points was reached and wheat/rice lands around them were surveyed for sparrow damage. Before starting the survey work at a given sampling point, one side of the road was

selected for survey for flipping a coin and then the assessor walked a 100 m transect perpendicular to the direction of the road sampling two quadrats (50 cm x 50 cm), located at 50 m and 100 m distance on the transect from the road. He then executed a 90 degree turn in the direction of travel and walked another 100 m transect sampling two quadrats as described below. After this transect was completed he then executed a second 90 degree turn toward the road and walked 100 m transect back to the road sampling another two quadrats at the prescribed intervals. After this transect was also completed, he then crossed the road and proceeded with the sampling work exactly the same way as described for the opposite side of the road.

Each ear within each quadrat was visually examined and estimate of the percentage of seed removed was recorded in a 5 percent incremented scale. Before taking up the assessment work, the assessor practised (using ears from which variable numbers of seeds had been removed) in assessing this variable accurately.

Damage to Wheat Crop

Table 1 documents information on the wheat lands that were sampled for the House sparrow damage located along different roads. In a sample of 504 19% (96) quadrats were found to have sparrow damaged ears in thems. A total of 29189 ears were visually examined of which 465 (1.6%) were found to be partitially (455) or completely (10) damaged (Table 2). The extent of the damage inflicted by the sparrow on the ears are shown in Table 3. It was estimated that from an average ear 21.6% of the seeds had been removed by the sparrows.

Damage to Rice Crop

In 348 of the rice field quadrats, 102 (29.3%) had damaged ears in them (Table 4). In these quadrats, 14803 ears was examined of which 469 (3.2%) had been attacked by the sparrows (Table 5). An average of .778% of the seeds had been removed by the sparrow from each of the 14503 ears (Table 6).

Table 1. Roadside Wheatlands surveyed for House Sparrow damage.

Sampling site	Sampling points	No. Quadrats sampled	Quadrats Showing Damage	
			Number	Percent
Faisalabad-Jhang Rd	5	60	6	10.0
Faisalabad-Aminpur Rd	5	60	5	8.3
Faisalabad-Samundri Rd	5	60	9	15.0
Faisalabad-Lahore Rd	5	60	4	6.7
Faisalabad-Jaranawala Rd	6	72	37	51.4
Faisalabad-Chak Jhumra Rd	4	48	11	18.3
Kamila-Rajana Rd	4	48	8	16.7
Kamlia-Chichanwanti	4	48	7	14.6
Kamlia-Mamunkajan Rd	4	48	9	18.8
Total	42	504	96	19.0

Table 2. Proportion of wheat ears showing House Sparrow Damage.

Total No. of ears examined	29189
No.of ears showing sparrow damage	465
Percent ears showing damage	1.6

Table 3. Extent of House sparrow damage to wheat ears.

% Damag to ears(X)	Frequency(f)	Fx
0	28724	0
5	268	1340
10	44	440
15	73	1095
20	12	240
25	20	500
30	4	120
35	10	350
40	8	320
45	2	90
50	9	450
55	-	-
60	1	60
65	-	-
70	-	-
75	2	150
80	2	160
85	-	-
90	-	-
95	-	-
100	10	1000
	29189	6315

$$\text{Mean} = \frac{6315}{29189} = 0.216$$

Table 4. Roadside ricelands surveyed for house sparrow damage.

Sampling site	Sampling points	No.quadrats sampled	Quadrats showing damage	Percent
1. Faisalabad - Sheikhupura Road	5	60	27	45.00
2. Faisalabad - Sumundri Road	5	60	16	26.67
3. Faisalabad - Jaranawala Road	5	60	19	31.67
4. Faisalabad - Sargodha Road	5	60	19	31.67
5. Kamlia - Chichawatni Road	3	36	7	19.44
6. Kamlia - Rajana Road	3	36	6	16.76
7. Kamlia - Massun Kajan Road	3	36	8	22.22
Total	29	348	102	29.31

Table 5. Proportion of rice ears showing House sparrow damage.

Total No. of ears examined	14803
No. of ears showing damage	469
Percent ears showing damage	3.16%

Table 6. Extent of House sparrow damage to rice ears.

% Damage to ears(x)	Frequency (f)	Fx
0	14300	0
5	152	760
10	104	1040
15	15	225
20	33	360
25	5	125
30	28	840
35	-	-
40	15	600
45	-	-
50	49	1080
55	-	-
60	18	1080
65	-	-
70	19	1330
75	-	-
80	11	880
85	-	-
90	12	1080
95	-	-
100	4	400
	14756	11470

$$\text{Mean} = \frac{11470}{14765} = 0.777$$

PROJECT TITLE: Inhibiting House mouse(Mus musculus) population in a Wheat-Sugarcane-Fodder Agroecosystem of Faisalabad.

STUDENT:

Student: Muhammad Saeed

Degree: M.Sc.

INTRODUCTION:

During the certain times of the year, the size of the house mouse (Mus musculus) habitat in croplands becomes too small and they become concentrated in field crops which offer suitable shelter and food. In the croplands of Faisalabad such a concentration of the mice and other murid populations take place in the month of November in sugarcane, fodder and vegetable fields. This month is, therefore, of crucial importance from the view point of control of rats and mice. During this month, most of the fields that had been under sugarcane, fodder and cotton crops are ploughed and prepared for the sowing of the wheat crop. Furthermore, as the weather turns cool, a decrease in the rate of reproduction of the house mouse sets in and continues through February. So the hypothesis is that if the November concentrations of the mice in sugarcane and vegetable fields

are destroyed, there will be little chance for them for building up their population till late spring unless there is a massive immigration from the adjacent fields. The present study was aimed at testing the above hypothesis by destroying the mice concentrations in sugarcane, fodder, and vegetable fields in November and then assessing the impact of this killing on the mice population at appropriate intervals of time.

OBJECTIVES:

To inhibit house mouse population in a wheat, sugarcane, and fodder dominated cropland near Faisalabad.

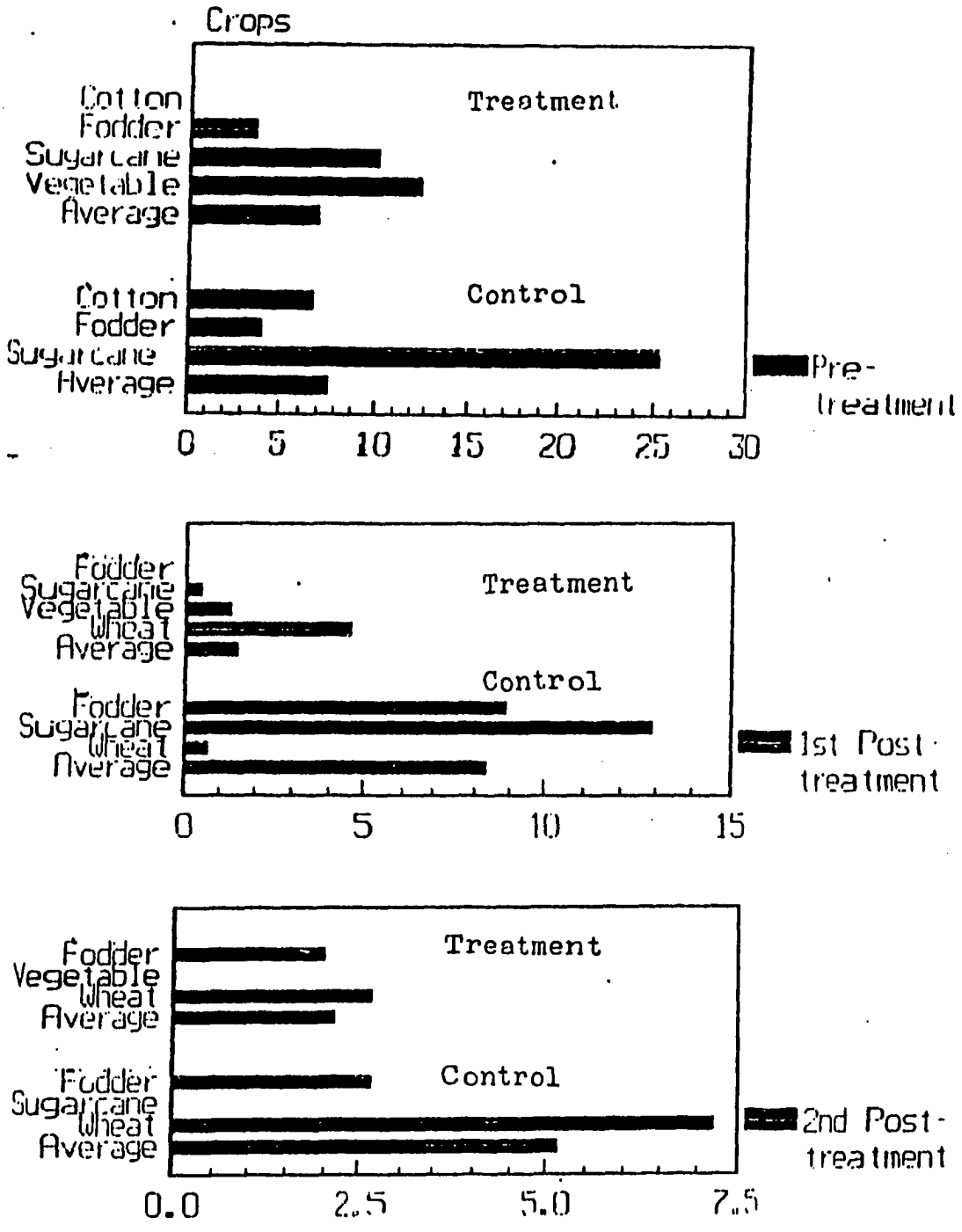
ACCOMPLISHMENTS:

This study on House mouse(Mus musculus) was carried out in a canal irrigated farmlands, two blocks of croplands, Treatment and Control Blocks located near village 61 J.B., Faisalabad District. Each of these two blocks comprised of six sub-blocks. Each of the sub-blocks consisted of 25 acres of intensively cultivated farmland. The Treatment and Control Blocks were located at a distance of about 1.5 km from each other.

Three trappings one pre-treatment and two post-treatment trappings were carried out in the Treatment and Control Blocks simultaneously. The pre-treatment trapping lasted from November 16 to 20, 1989. Eight acres of croplands under various crops from each of the two blocks were sampled for five days using 15 snap traps (10 rat traps and 5 mouse traps) per acre of the fields. From the Treatment Block 42 and from the Control Blocks 46 mice were captured. The trap success for the two blocks was 7.00% and 7.66% , respectively (Fig. 1). Tracking tile data from each of the fields that was to be trapped was obtain just before and after the 5 - days trapping. Neither the tracking tile data nor the removal data were found fit for estimating the size of the mice population

Twenty acres eleven acres of sugarcane, six acres of fodder, and three acres of vegetable and croplands of the Treatment Block were treated with a poison bait (zinc phospdide) from November 24 through 26,1989 following two days of prebaiting. Bait stations were established in each of these 20 acres of fields crops.

Fig 1. Trap success of House mouse in the treatment and control fields during November1989, December1989 and March1990.

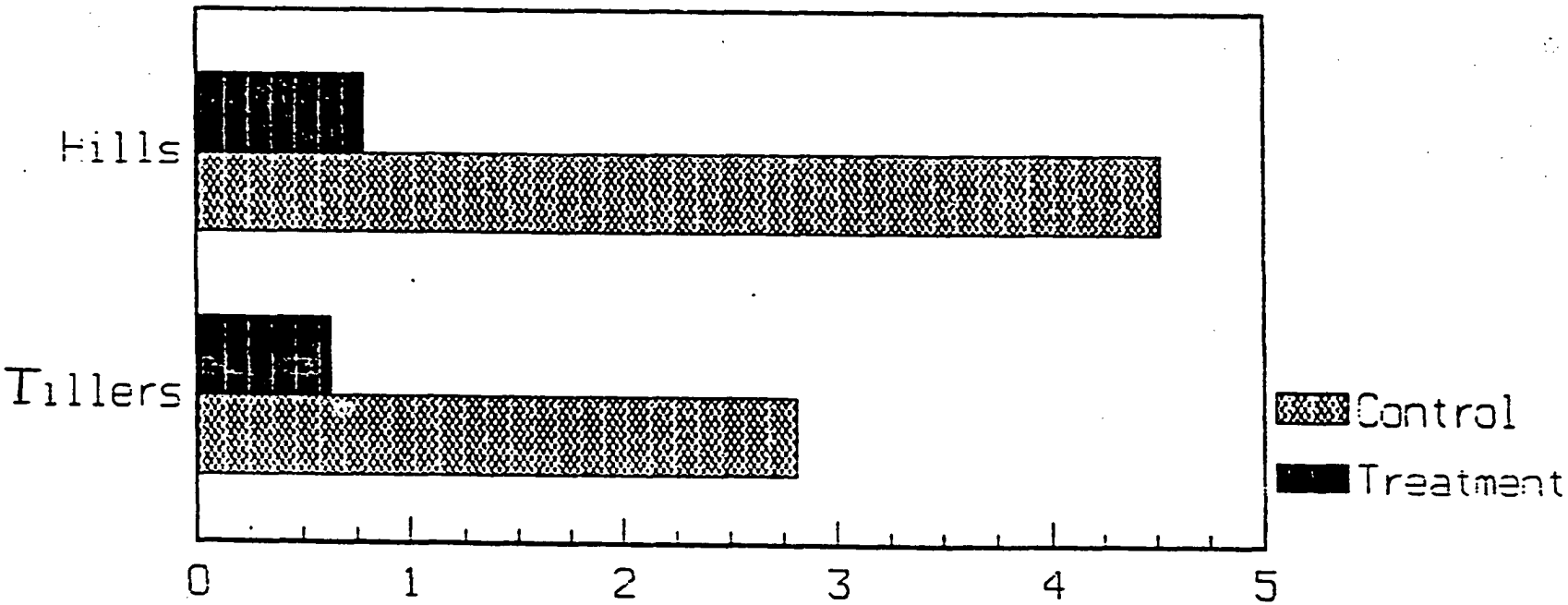


Burrow baiting was also done in all the sugarcane fields in which the crop was still standing or had recently been harvested.

The first post-treatment trapping was done on eight acres of croplands from the Treatment and Control Blocks. Tracking tile data was also obtained The trap success of mice for the Treatment Block was 1.5% and for the Control Block it was 8.33%. The second post-treatment trapping was carried out in the two blocks from March 19 to 23,1990. In the Treatment Block trap success was 2.16% and in the Control Block it was 5.17% (Fig. 2). Tracking tile and removal data were deficient and could not be used for estimating the size of the mice population.

Damage to wheat crop in the Treatment and Control Blocks was estimated on April 17 and 18,1990, using a quadrat (50 cm x 50 cm) along a transect line. In the Treatment Block, six acres of fields under wheat crop was sampled. An examination of 4122 wheat tillers from

Fig. 2 Percentage of damaged hills and tillers in the treatment and control blocks.



these fields revealed that 0.63% of tillers had been damaged by rats and mice. In Control Block 4051 tillers were checked of which 2.81% had been cut by rats and mice. It was concluded that the poison baiting in November helped in protecting 2.18% of the tillers in the Treatment Block.

The average per acre yield for the wheat fields of Treatment Block was 1400 Kg and the current price of 1 Kg of wheat in the local wholesale market was Rs. 3.1, from these figures it was computed that on each acre of wheatland of the Treatment Block 30.5 Kg of wheat worth Rs. 94.6 was saved from the depredations of rats and mice. As the Treatment Block was cropped to 90 acres of wheat, wheat grain worth Rs. 8694 was saved at a cost of Rs. 738 spent on excuting the November poison baiting.

PROJECT TITLE: A method of inhibiting the soft-furred field rat (*Rattus meltada*) in a Wheat-Sugarcane-Fodder system of croplands.

STUDENT:

Name: Sher Muhammad Khan

Degree: M.Sc.

INTRODUCTION:

Recent studies on the rats and mice of the croplands of central Punjab indicated that the soft-furred field rat is a common and important component of the rodent communities of the croplands of Punjab. Mukhtar's (1989) studies on the dynamics of the population of the soft-furred field rat in the croplands of Faisalabad indicated that the rat achieved high population densities in the cane and fodder crops in the fall and that generally it did not infest the wheat fields before January. As the area under wheat crop is several folds larger than what it is jointly under sugarcane and fodder crops in November, it would be advisable ti kill the rats in these crops before they emigrate and exploit

the rich and abundant resources in the wheat fields. Furthermore, as the rat does not breed during the colder months of the winter season (Mustafa, 1989), it will not be possible for its population to rebuild till late spring after being cut down in late fall.

OBJECTIVES:

To protect the wheat crop from the depredation of the soft-furred field rat (Rattus meltada) by using a poison bait (zinc phosphide) in November in sugarcane, fodder and vegetable fields.

ACCOMPLISHMENTS:

The study was carried out from November, 1989 through April, 1990 in the wheat, sugarcane and fodder dominated farmlands located near Chak No. 61 J.B., Faisalabad. The study area was comprised of two bolcks, Treatment Block (T) and Control Block (C) each of which consisted of six sub-blocks . Each of the sub-blocks had a land area of 25 acres. These two blocks were located at about a distance of 1.5 km from each other. In both the blocks wheat, fodder and sugarcane were the dominant

crops. Cotton was a minor crop. Vegetable were also grown in some of the fields of treatment and control blocks.

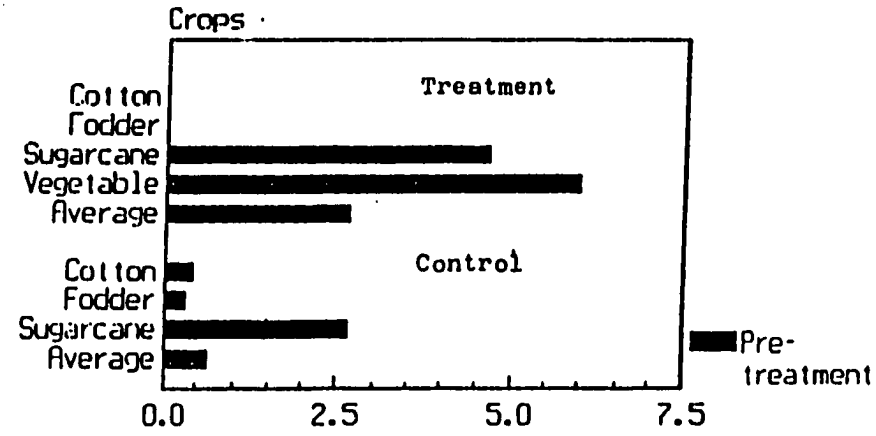
From each of the two blocks, eight acres of fields under different crops were sampled thrice for rats and mice using snap traps. The first trapping was carried out from November 16 through 20,1989. Fifteen traps (10 rat traps and 5 mouse traps) were set for five conseutive days in each acre of the selected fields. Ten inked vinyl tiles were put in each of the one-acre fields for one night immediately before and after the trapping session, 16 metads were captured. The over all trap success for this period was 2.66% in the Treatment Block and 0.66% in the Control Block (Figs. 1 and 2).

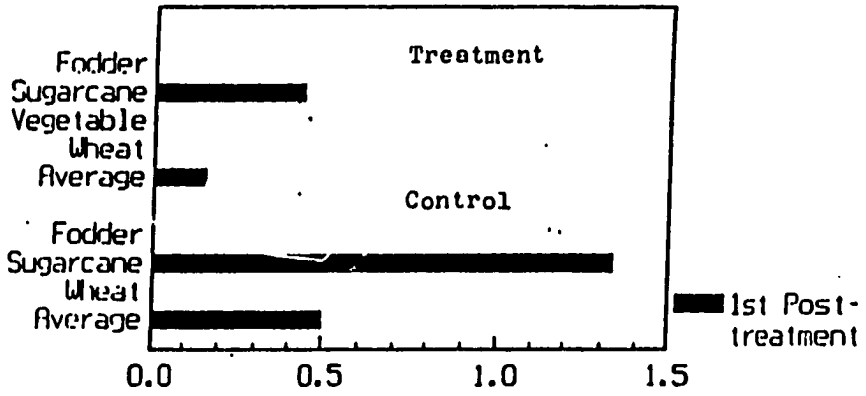
All the fields in the Treatment Block which had sufficient vegetation cover to offer shelter to the rats were treated with zinc phosphide bait. In all, eleven acres of sugarcane, six acres of fodder and three

acres of vegetable fields were treated with the poison bait. Poison baiting preceeded two days of pre-baiting. Poison baiting which preceded two days of pre-baiting was done for three days from November 24 through 26,1989. The bait was put at nine stations in each of the one-acre. fields. In addition to surface baiting burrow baiting was also carried out in 11 acres of sugarcane fields.

The first post-baiting sampling using inked tiles and traps was done from December 10 through 16, 1989 over eight acres of cropland in each of the two blocks. In the treatment Block, trap success for the metads was 0.16% and 0.5%. The second post-baiting sampling was carried out from March 18 through 24,1990. The trap success was 0.66% in the Treatment Block and 0.5% in Control Block (Figs. 1 and 2). The tracking tiles as well as the trapping data obtained during November (1989) , December (1989) and March (1990) were deficient and therefore, it was not possible to estimate the size

Fig.1 Trap success of Rattus meltada in the Treatment and Control fields during November1989, December1989 and March1990.





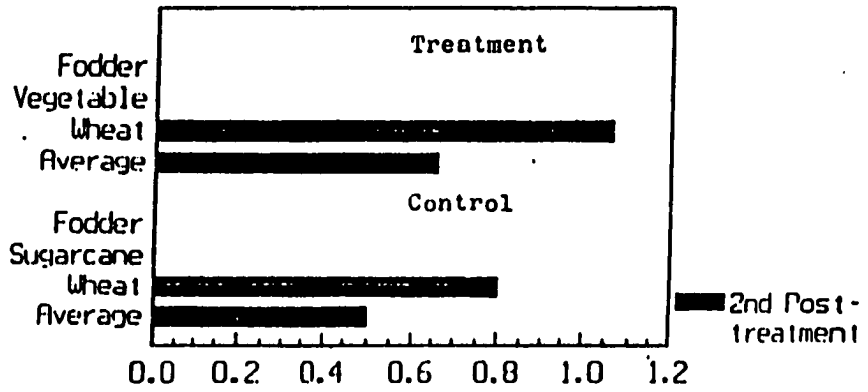
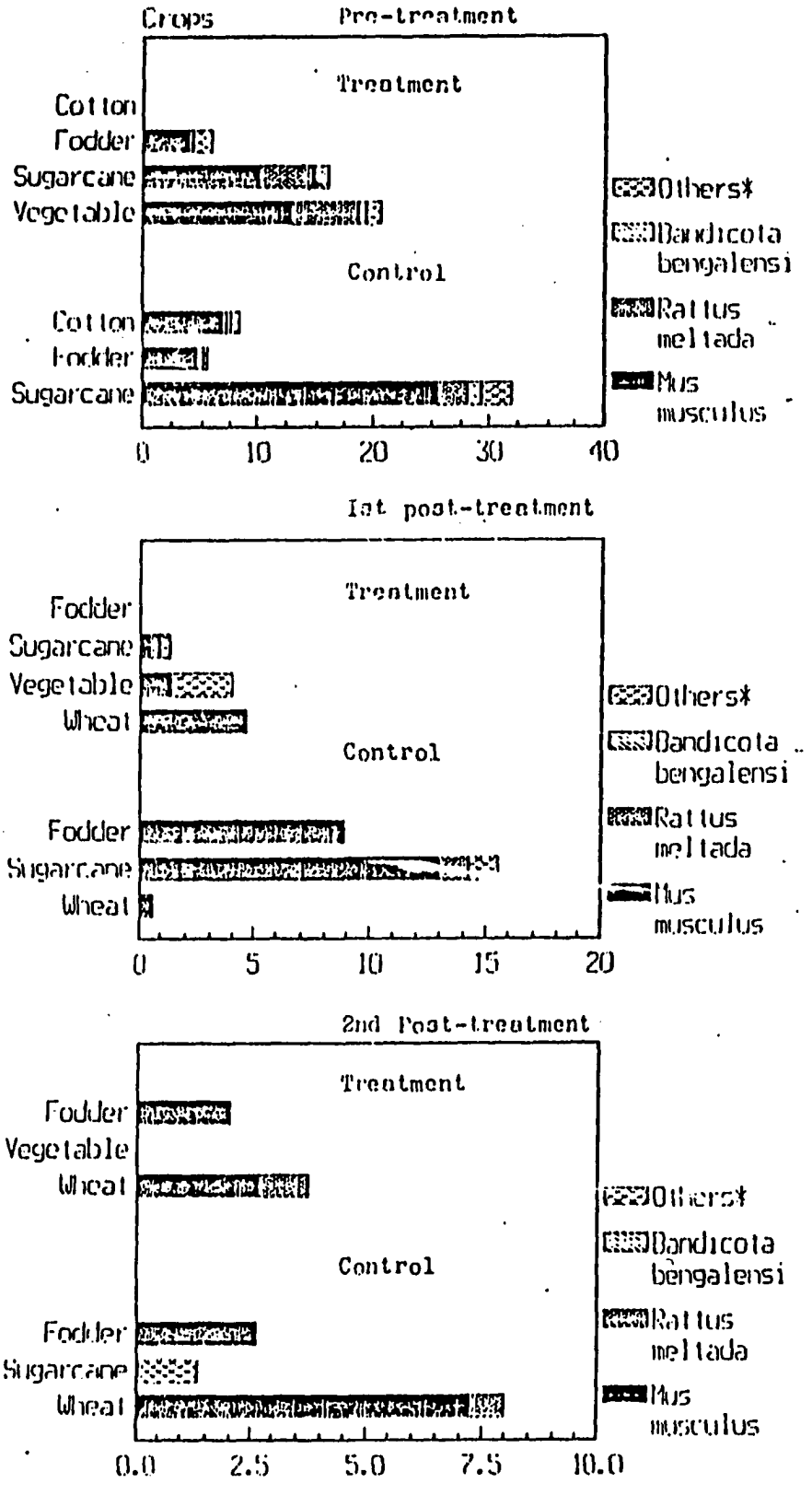


Fig 2 Trap success of rats and mice in the treatment and control blocks.

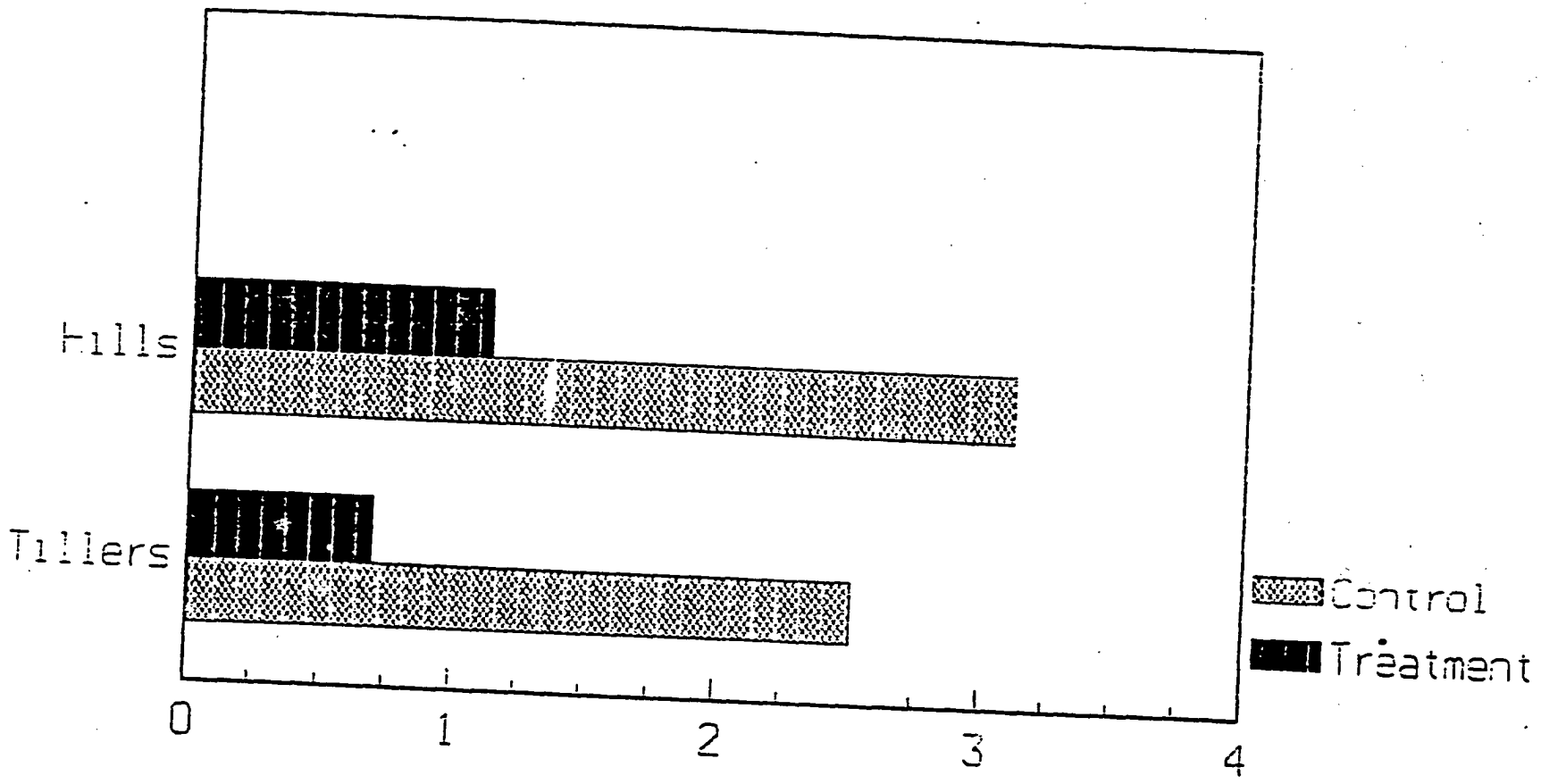


Others* = Tatera indica
Suncus murinus

of the rat population living in the Treatment and Control Blocks.

Rodent damage to the wheat crop of the Treatment and Control Blocks was obtained using a 50 x 50 cm quadrat. It was estimated that 0.70% of the tiller in the wheat fields of the Treatment Block and 2.51% in the Control Block had been damaged by the rodents (Fig. 3). Thus, the wheat crop of the Treatment Block received 1.81% less damage than that of the Control Block. Of a total of 150 acres of land of the Treatment Block 90 acres were cropped to wheat. The average per acre yield from these fields was 35 kg. The average current price of 1 kg of wheat in the local wholesale market was Rs. 3.1. From these figures it was calculated that at (1.81% less loss) wheat worth Rs. 7069 was saved on the Treatment Block from being destroyed by the rodents. The total expenditure on the poison baiting was Rs. 737. Thus, the net saving was Rs. 6332.

Fig.3. Percentage of damaged hills and tillers in the Treatment and Control blocks.



PROJECT TITLE: Inhibiting lesser bandicoot rat (*Bandicota bengalensis*) population in a Wheat-Sugarcane-Fodder system of cropland.

STUDENT:

Name: Muhammad Raza Hassan

Degree: M.Sc.

INTRODUCTION:

Like other murid pests of croplands, the bandicoot rat (*Bandicota bengalensis*) shows considerable changes in its population density. These changes are related with season and size of the available cover. Siddique's (1989) studies on the abundance of the bandicoot rat in the wheat-sugarcane-fodder cropping system of Faisalabad revealed that sugarcane provided shelter to the rat almost throughout the year. The rats start moving into the wheat fields in February and reached peak abundance in March. In the fodder fields, abundance peaks were reached in the months of May and August, whereas in the cane fields high population density was attained during the fall. The August peak in fodder crops and the fall

peak in sugarcane resulted from high rate of reproduction in the spring and summer seasons (Rana 1989) and crowding of the rats over a small area of suitable cover offered by these crops. In November, most of the fodder(which are under graminoia species) and cane fields are harvested ploughed, and prepared for sowing of the wheat crops. Naturally the rats concentrates fields where the crop is still standing. It may also be pointed out that the bandicoot rat does not reproduce during the winter season (Rana, 1989). If the rat concentrations in the cane and fodder fields are destroyed, the chance of rebuilting its population through reproduction till the harvesting season of the wheat crop will be very slim. So, it was hypothesised if the rat population in the cane, fodder and vegetable fields was reduced in November it would pose no problem to the wheat crop in the spring. The three crops mentioned above jointly cover about 13% of the total land areas of the croplands as compared to 60% of the wheat crop.

OBJECTIVES:

To reduce bandicoot rat depredation on the wheat crop with minimum use of zinc phosphide baits.

ACCOMPLISHMENTS:

This study was carried out on two blocks of croplands from November, 1980 through April, 1990 in the wheat sugarcane and fodder dominated farmlands located near Chak No. 61 J.B., Faisalabad. The two blocks, Treatment and Control Blocks consisted of 150 acres of land each and were located about 1.5 km apart.

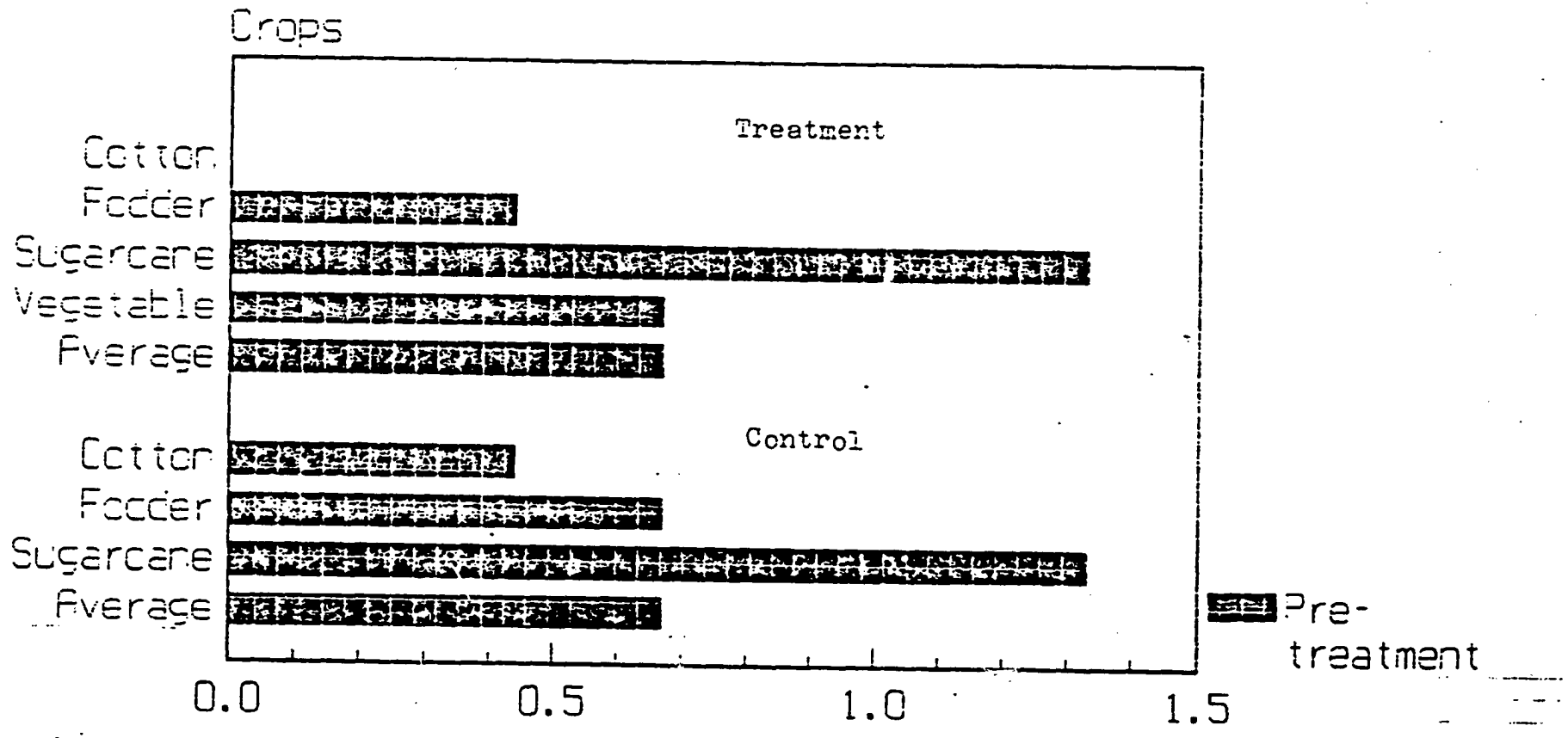
From each of the two blocks, eight acres of fields under different crops were sampled their for rats and mice. The first trapping was carried out in November from 16 through 20,1989. Fifteen traps (10 rat and 5 mouse traps) were set for five consecutive nights in each of the eights acres of the randomly selcted fields. Ten inked vinyl tiles were put in each acre of these fields for one night just before and another night just after the trapping. The overall trap success for the bandicoot rat was 0.67

per cent each in the Treatment and Control Block.(Fig. 1).

In November 11 acres of sugarcane, six acres of fodder, and three acres of vegetable fields were treated with zinc phosphide bait for three days from November 24 through 26 (1989). Poison baiting preceded two days of pre-baiting . The baits were put at nine stations in each one-acre field. In addition to surface baiting, burrow baiting was also carried out in the 11 acres under sugarcane.

The first post baiting sampling was done, using inked tiles and traps, from December 10 through 16,1989, over eight acres of cropland in each of the two blocks. The second post-baiting sampling carried out from March 18 through 24,1990. On both the occassions no specimens of the bandicoot rat was captured. The tracking as well as the trapping data obtained during the three samplings were deficient and could not be used for estimating the size of rodent populations.

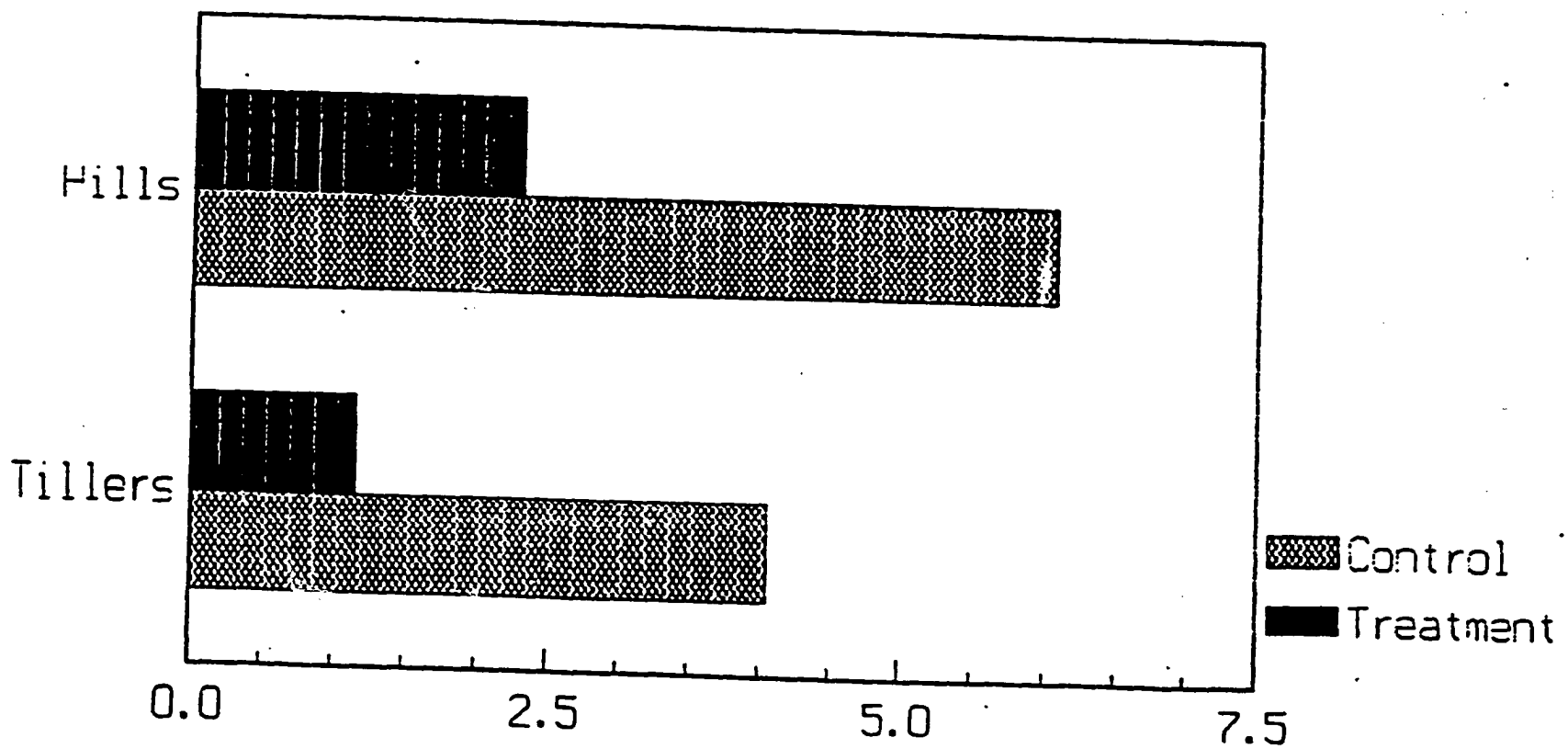
Fig.1 Trap success of B.bengalensis in the treatment and control fields during November 1989, December 1989 and March 1990.



Two acres of the sugarcane crop in the Treatment Block and six acres in the Control Block was sampled for rodent damage. The proportion of freshly damaged canes was 6.3% in the Treatment Block and 47.4% in the Control Block. Eighty nine acres of freshly harvested wheat fields in the Treatment Block and 71 acres in the Control Block were surveyed for rat's burrows systems in the first hall of April. The Treatment fields had an average of 0.85 bandicoot and 0.66 Indian gerbille burrows and the Control fields had 2.80 bandicoot and 1.91 gerbille burrows per acre of the wheat fields.

Rodent damage to the wheat crop of the Treatment and Control Blocks was obtained during a 50 x 50 cm. quadrat. It was estimated that 1.15 per cent of the wheat tillers in the Treatment Block and 4.05 per cent in the Control Block had been damaged by rats (Fig. 2). Thus, the wheat crop of the Treatment Block received 2.90 per cent less damage than that of the Control Block . It was estimated that the poison baiting in November (1989) saved wheat grain worth Rs. 11340 on 90 acre of wheat land of the Treatment Block. The total expenditure on the November

Fig.2 Percentage of damaged hills and tillers in the treatment and control blocks.



baiting equalted to Rs. 737. Thus, there was a net saving of Rs. 10603 on the 90 acres of the wheat fields of the Treatment Blocks.

PROJECT TITLE: Food habits of *Bandicota bengalensis* in a wheat - sugarcane - fodder agrosystem of Faisalabad.

STUDENT:

Name: Abida Butt

Degree: M.Sc.

INTRODUCTION:

The bandicoot rat (*Bandicota bengalensis*) is a serious pest of agriculture. It infests a variety of crops, but rice, wheat, and sugarcane are its main targets of depredation. Fulk and Akhtar (1981) reported that it reduces the average yield of rice by 19%. By virtue of its hoarding habits it is able to exacts a sizable share of the production of cereal crops at the time of harvest.

Some information is already available about the population density of this rat in the croplands of Punjab (Siddique, 1989; Maqbool, 1990) as well as about the amount of food an average bandicoot consumed daily (Wadood, 1980). This study was aimed at knowing the rat's

food habits in the fields so that our knowledge about the rat's impact on the yield of crops could be improved.

OBJECTIVES:

To know about the diet of the rat in the agrosystem of Faisalabad which is predominantly comprised of wheat, sugarcane, and fodder crops.

ACCOMPLISHMENTS:

Sixty two specimens of the bandicoot rat (Bandicota bengalensis) were trapped from sugarcane, wheat, fodder and vegetable fields of central Punjab during the period extending from August, 1988 through June, 1989. Analysis of the stomach contents of these specimens revealed that they exploited 18 species of plants to fulfil their dietary requirements. Sugarcane, which was consumed almost throughout the year, constituted 58.57% of total dry weight of the annual diet of the rat. Wheat (13.61%) and sorghum (8.28%) were eaten moderately, whereas other food items were consumed only in small amounts. Animal food accounted for only 3.77% of the total dry weight (Table 1).

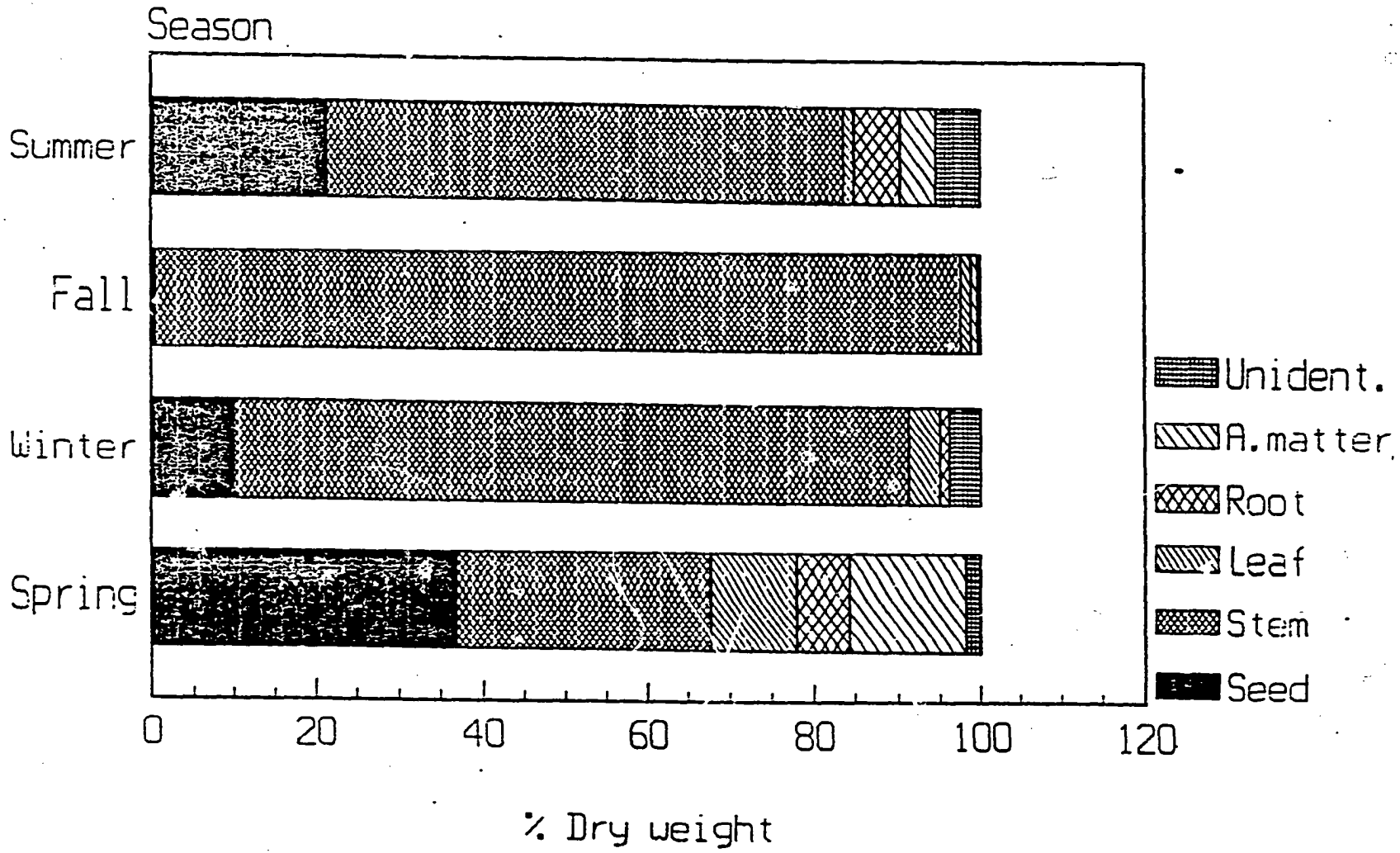
Table 1. Diet of the bandicoot rat (B. bengalensis) as revealed from the analysis of the contents of 62 stomachs.

Food items	Tot. No. occulars	No. occulars containing food items											+ Ve No. occulars	% Freq.	Rel. density	% Dry wt.
		Aug	Sep (1988)	Oct	Nov	Dec	Jan (1989)	Feb	Mar	Apr	May	Jun				
1. Sugarcane	620	35	48	77	140	38	-	18	13	1	10	12	392	63	0.99	58.57
2. Wheat	"	40	-	-	1	13	-	12	22	20	23	-	131	21	0.23	13.61
3. Phalaris minor	"	1	-	-	1	8	-	-	12	-	4	5	31	5	0.05	2.95
4. Lucern	"	5	-	-	1	-	-	-	7	-	7	9	29	5	0.05	2.95
5. Chenopodium album	"	1	-	-	-	-	-	3	-	-	-	-	4	1	0.01	0.59
6. Trifolium alexnanderinum	"	11	-	-	-	-	-	4	2	-	-	-	17	3	0.03	1.77
7. Lepidium sativum	"	1	-	-	-	-	-	-	-	-	-	-	1	0	-	-
8. Sorghum vulgare	"	31	20	8	16	-	-	-	-	-	-	8	83	13	0.14	8.26
9. Brassica	"	-	-	-	1	-	-	-	-	-	-	-	1	0	-	-
10. Chenopodium murale	"	-	-	-	-	-	-	-	1	-	-	-	1	0	-	-
11. Portulaca oleracea	"	13	-	-	-	-	-	-	-	-	-	-	13	2	0.02	1.18
12. Trigonella foenum	"	-	-	-	-	-	-	6	-	-	2	-	8	1	0.01	0.59
13. Sperrula rubra	"	3	-	-	-	2	-	1	-	-	3	2	11	2	0.02	1.18
14. Rice	"	1	-	-	-	-	-	-	-	-	-	-	1	0	-	-
15. Cat	"	4	1	-	-	-	-	-	9	-	-	-	14	2	0.02	1.18
16. Sonchus	"	4	-	4	-	-	-	-	-	-	-	-	8	1	0.01	0.59
17. Medicago polymorpha	"	-	2	-	-	-	-	-	-	-	1	-	3	0	-	-
18. Coriander	"	-	-	-	5	-	-	-	-	-	-	-	5	1	-	-
19. Animal matter	"	6	5	-	-	-	-	-	4	-	20	4	39	6	0.06	3.77
20. Unidentified	"	8	1	1	-	6	-	2	1	2	1	5	27	4	0.04	2.35

The summer diet was most diversified (Berger - Parker index = 0.296) when sugarcane (24.4%), wheat (20.24%) and sorghum (19.64%) were eaten intensively and almost in equal quantities. During fall (90.21%) and winter (70.93%), sugarcane became the dominant item of the diet of the rat; the diversity index for these seasons being 0.808 and 0.584. Maximum consumption of wheat was recorded during the summer season when it constituted 48.42% of the total dry weight of the rats diet, the diversity index was 0.425. Fodder and various weeds were consumed moderately, whereas animal food was best consumed (13.83%) in the spring season.

Rats captured from sugarcane and wheat fields were found eating mainly the canes (79.16%) and wheat(53.39%), respectively. The rats taken from the fodder crops tended to have most diversified diet as the bulk of their food was obtained from varied sources, namely, wheat (30.90%), sugarcane (16.36%), Trifolium (6.96%), sorghum (7.27%), and Phalaris (6.06%). Animal food was best consumed by the

Fig.1. Proportion of different parts of plants in the diet of the B.bengalensis.



rats taken from the vegetable fields.

Although the rats feed on all the four major parts of the plants, namely, seeds, leaves, stems and roosts, yet stems and seeds were the main staples. Stems dominated in all the seasonal samples except that of the spring where dominance was shared with seeds(Fig. 1).

On the whole, sugarcane, wheat, sorghum, lucern and animal food were the main staples of the rat's diet as they jointly accounted for 87.18% of the total dry weight of the annual diet.

Fulk,G.W.,and M.T.Akhtar,1981. An investigation of rodent damage and yield reduction in rice. Trop.Pest Mhmt., 27(1): 116-120.

Maqbool,M. 1990. Studies on population dynamics and reproduction of rats and mice in a Wheat-Rice-Fodder agrosystem. M.Phil. thesis,Deptt. of Zoology & Fisheries,Univ.of Agri.,Faisalabad. pp. 105.

Siddique,M. 1990. Seasonal changes in the abuhdance of Bandicota bengalensis in an irrigated croplands. M.Sc. thesis,Deptt.of Zool.& Fisheries,Univ.of Agri.,Faisalabad. pp. 89.

Wadood,A. 1980. Study of food consumption and preference by Bandicota bengalensis. M.Sc. thesis, Deptt.of Zoology & Fisheries,Univ. of Agri., Faisalabad. pp. 58.

PROJECT TITLE: Food habits of Rattus meltada in the croplands of Faisalabad.

STUDENT:

Name: Tasleem Akhtar

Degree: M.Sc.

INTRODUCTION

The soft-furred field rat(Rattus meltada) is one of the commonest rats of croplands in Punjab where it infests and destroys all the major crops, namely, wheat, sugarcane and rice. The soft-furred field rat is a relatively less known species especially with respect to its diet. Inorder to assess its exact pest status, we need to know its population size and dietary habits in the wild. Recently, some information has been made available about the density of the rat in the croplands of Faisalabad (Mukhtar, 1989), and Gujranawala (Maqbool, 1990). However, information about its food habits are scanty.

OBJECTIVES:

To know something about the diet of the rat in the croplands of Punjab.

ACCOMPLISHMENTS:

A total of 196 specimens of soft-furred field rat (Rattus meltada) was trapped from canal irrigated croplands of central Punjab during the period extending from August, 1988 through June, 1990. Twenty species of plants were found represented in the stomach contents of these rats. Of these plants, wheat was consumed most intensively as it accounted for 35.66% of the total dry weight of the stomach. Lucern (10.82%), sugarcane (10.82%), and sorghum (10.82%) were the other important items in the diet. Animal food constituted only 0.63% of the total weight of the contents. Unidentified items constituted 3.18% of the total weight (Table 2).

During the summer season, wheat was pre-dominant as it constituted 63.98% of the total dry weight. In the fall samples, dominance was co-shared by sorghum (19.07%), wheat (16.44%), lucern (13.82%), and sugarcane (13.15%). In the winter season, sugarcane became the best consumed item as it constituted 33.10% of the diet.

Table. 1. Diet of the soft-furred field rat (Rattus meltada) as revealed from the analysis of the contents of 190 stomachs.

Food items	Total No. occulars	Aug 1988	Sep	Oct	Nov	Dec	Jan 1990	Feb	Mar	Apr	May	Jun	Jul	+ ve occulars	% Freq.	Relative density	% Dry weight
	1960																
Wheat	200	91	82	48,	53	3	16	36	-	153	162	-	844	43	0.56	35.66
Lucern	59	89	41	60	22	2	3	9	-	7	12	-	304	16	0.17	10.82
T. alexandrinum	47	14	28	27	30	2	-	3	-	15	22	-	186	10	0.10	6.36
Medicago	6	11	23	17	-	-	-	5	-	1	1	-	64	3	0.03	1.91
C. album	30	31	29	52	31	11	2	2	-	9	3	-	200	10	0.10	6.36
C. murale	6	3	16	11	1	-	-	-	-	2	-	-	39	2	0.02	1.27
Sugarcane	34	33	33	115	63	30	-	6	-	-	3	-	322	16	0.17	10.82
Sorghum	44	154	69	22	4	-	-	-	-	8	7	-	308	16	0.17	10.82
Brassica	2	1	6	1	2	1	6	-	-	6	3	-	28	1	0.01	0.63
Coriander	3	5	7	25	13	1	-	1	-	7	13	-	75	4	0.04	2.54
Spergula	29	35	23	11	3	-	-	8	-	1	5	-	115	6	0.06	3.82
M. minor	10	11	25	3	-	1	-	-	-	6	2	-	58	3	0.03	1.91
E. heliscopia	1	2	6	3	6	-	-	-	-	1	1	-	20	1	0.01	0.63
P. oleracea	5	3	18	13	4	-	-	-	-	4	1	-	48	2	0.02	1.27
Oat	-	-	9	5	2	-	-	1	-	2	-	-	19	1	0.01	0.63
Gram	-	-	6	11	-	-	-	-	-	-	-	-	17	1	0.01	0.63
Rice	-	-	-	-	2	-	-	1	-	-	-	-	3	0	0.00	0.00
T. foenum	-	-	-	-	-	-	-	-	-	1	-	-	1	0	0.00	0.00
Sonchus	-	-	3	-	-	-	-	-	-	-	-	-	3	0	0.00	0.00
Millet	-	-	5	-	-	-	-	-	-	-	-	-	5	0	0.00	0.00
Animal matter	-	1	7	1	5	-	-	2	-	2	1	-	19	1	0.01	0.63
Unidentified	16	21	15	21	10	2	1	0	-	4	8	-	101	5	0.05	3.18

Wheat (22.76%), Chenopodium album (12.41%), Trifolium alexandrinum (8.28%), and lucern (6.89%) were among the other important constituents of the rat's diet. In the spring diet wheat once again became the pre-dominant item, 82.73% of the dry was due to this item alone.

In specimens captured from sugarcane fields, sugarcane (34.56%) and wheat (28.39%) were the two intensively consumed items in the diet of the rats. In specimens from fodder and wheat fields, wheat (39.80%), (57.96%) and lucern (12.32%), (8.92%) were the staples of the rats diet. In the animal from the vegetable fields, lucern (20.86), wheat (17.98%), C. album (12.95%), T. alexandrinum (10.79%), and coriander (10.07%) were the staples of the diet of the rat. In the specimens from cotton fields, wheat (38.22%), and sorghum (24.2%) were dominant food items of the stomach contents. In the annual diet of the rat stems of plants were eaten most intensively as they accounted for 51.29% of the dry weight of the stomach contents. Seeds (26.94%) were the next best

Fig. 1 Proportion of different parts of plants in the diet of the *R. meltada.*

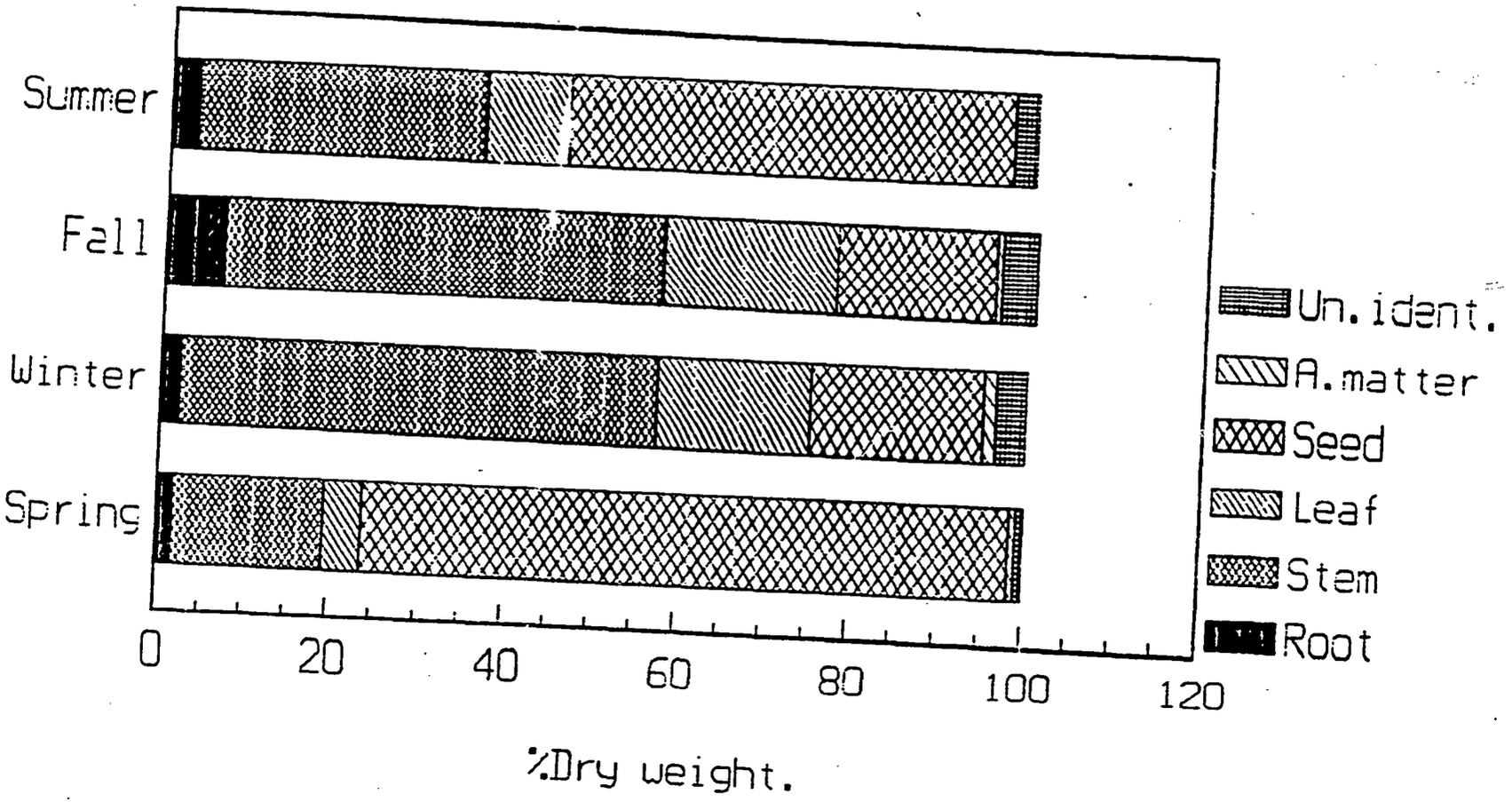


Table 2. Index of diversity for the diet of *R. meltada* in different seasons and habitats.

Season	1/d	Habitat	1/d
Summer	1.686	Fodder	2.262
Fall	5.319	Cotton	3.184
Winter	2.105	Vegetable	3.831
Spring	1.225	Wheat	1.62
		Sugarcane	2.463

consumed items, whereas leaves (15.02%) were eaten less intensively. The roots comprised only a small portion of the rats diet (Fig. 1).

Species diversity and dominance of particular kind of food in the contents of the rats stomach was measured by Berger - Parker index (d). Inorder to insure that the index increased with increasing diversity, its reciprocal (1/d) was used. The 1/d values for various seasons habitats of capture of the rat are given in Table 2. From this table it is quite clear that the rat ate more varied diet during the fall season than in other seasons. Similarly rats living in cotton and vegetable fields exploited several sources for fulfiling their dietry needs.

Mukhtar, M.K. 1989. Movement patterns and seasonal changes in the abundance of Millardia meltada in the canal irrigated farmland of central Punjab.M.Sc. thesis,Deptt.of Zoology & Fisheries,Univ.of Agric., Faisalabad. 93 pp.

Maqbool,M. 1990. Studies on population dynamics and reproduction of rats and mice in a wheat-rice-fodder agroecosystem. M.Phil. thesis,Deptt.of Zoology & Fisheries,Univ.of Agric., Faisalabad. 105 pp.

PROJECT TITLE: Food habits of *Tatera indica* in Wheat-Sugarcane-Fodder croplands of Faisalabad.

STUDENT:

Name: Riffat Amir

Degree: M.Sc.

INTRODUCTION:

The Indian gerbille(*Tatera indica*) is generally associated with cultivated tracts and is found throughout the irrigated canal colonies of the Punjab. In some villages it has become commensal(Roberts, 1977). In the cultivation it occupies a variety of habitats, but is said to have achieved the greatest abundance near farmlands and human dwellings (Prater, 1971; Prakash,1962). It is an important pest of agricultural crops, particularly in those areas where sandy and alkaline patches of land occur scattered almost the croplands. In the croplands, it feeds on the tender stems leaves, saplings and grains of cereals (Prasad, 1953, 1954).

OBJECTIVES:

The present study is aimed to knowing the diet of T. indica inhabiting the croplands of central Punjab where wheat, sugarcane and fodder were dominant crops.

ACCOMPLISHMENTS:

A total of 93 specimens of the Indian gerbille (Tatera indica) was taken from croplands and farm houses of central Punjab. In the croplands wheat-sugarcane-fodder pattern of cropping was practised. These specimens were captured during the period extending from August, 1988 through April, 1990. An analysis of the stomach contents of these specimens revealed that 21 different species of plants were exploited by the gerbille to meet its dietary requirements. In the annual diet, wheat constituted 53.45% of the total dry weight of the stomach contents (Fig. 1). Sorghum (7.76%) and Chenopodium album (6.03%) were eaten much less intensively. Other food items were consumed only in small amounts. Animal food accounted for only 0.86% of the diet.

In all the seasonal samples, wheat was predominant. In the summer, diet, wheat accounted for 44.35%, Chenopodium murale (8.05%), and sorghum (7.14%) of the total dry weight of diet of the gerbille. Other food items were eaten in small quantities. Animal food constituted 2.68% of the gerbille's diet. During the fall season wheat accounted for 41.07% of the total dry weight. Sorhum (19.64%) was the next best consumed item. Lucern (6.25%), C. album (3.58%), C. murale (4.46%) and rice (6.25%) were eaten less intensively. Wheat contributed 57.69% of the total dry weight of the winter diet. C. album (13.08%), Lucern (3.84%), and rice (3.08%) were the other important constituents of the winter diet. In the spring season, wheat became a very predominant component of the diet of the gerbille as it accounted for 84.24% of the total weight of the stomach contents.

When the diet of the gerbille was considered according to their habitat of capture, it was found that those from fodder fields were found consuming

wheat (29.02%), sorghum (21.17%) and millet (15.33%) in significant quantities. Specimens from wheat fields consumed mainly wheat (65.65%), C. album (10.69%), and spergula (9.16%). In specimens from the cotton fields wheat (40.78%) and sorghum (19.10%) were the two major food. Other food items were eaten much less intensively. In specimens taken from farm houses (56.68%) and village houses (95.45%) wheat was the main staple of the gerbille's diet.

Seeds of plants were the main staples of the diet of the gerbille which constituted 56.35% of its total dry weight. Stem (23.02%) and leaves (14.29%) also contributed significantly but roots were eaten only in small quantities (Fig. 1).

As judged from Berger - Parker index of diversity, the diet of the gerbille was most varied during the summer and fall season, less varied in the winter season and least varied in the spring season (Fig. 2). During the latter two seasons, and particulary

Fig.1 Proportion of differnt parts of plants in the diet of the T. indica

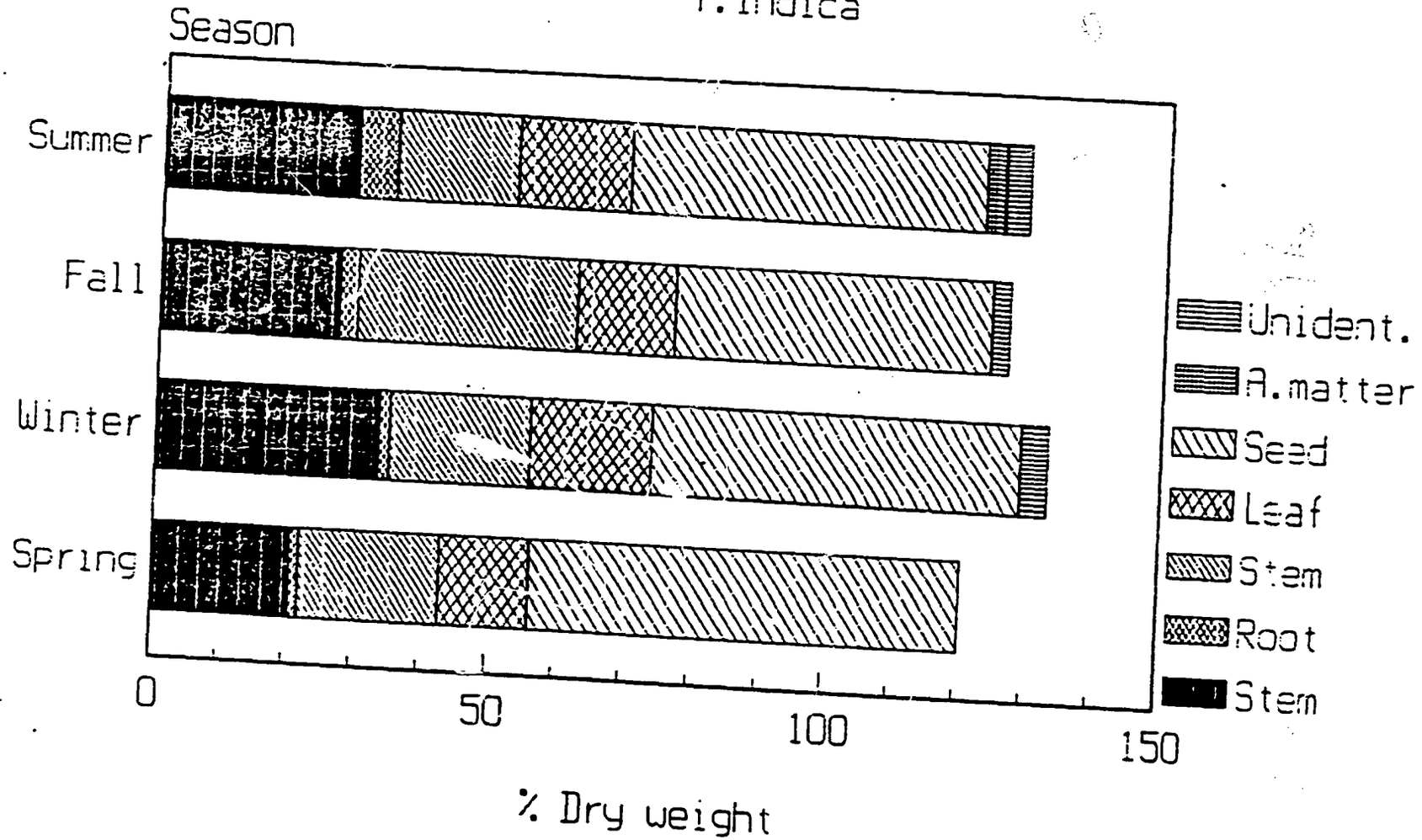
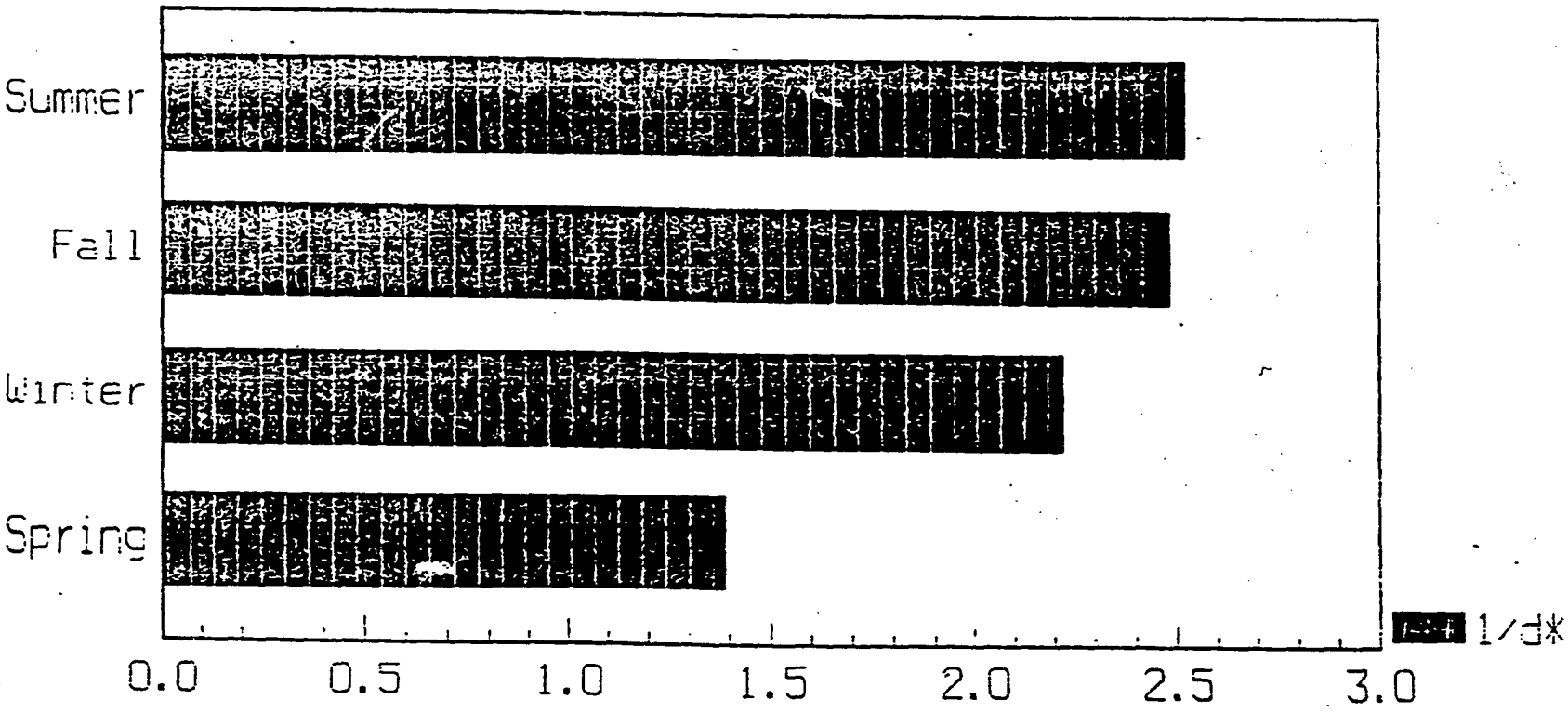


Fig.2 - Dominance index (Berger-Parker index) for seasonal samples of stomach contents of T. indica.



* Reciprocal of Berger-Parker index.

20

in the spring season, the gerbille heavily depended on wheat. Fig. 4 b shows that rats from fodder crops had most varied diet.

From about 75% to 88% of the total weight of the diet of the gerbille was due to food crops. Weeds accounted for 12% to 21% of the total weight.

Beg,M.A.,A.A.Khan and M.Yasin, 1977. Rodent damage to wheat crop in Faisalabad District. Pak.J.Agri.Sci., 14: 37-44.

Prasad,M.R.N. 1954. Food of the Indian gerbille, Tatera indica cuveri (waterhouse). J.Bomb.Nat.Hist.Soc., 52: 321-325.

Prater,S.H. 1971. The Book of the Indian Animals (Mammals). 3rd Ed. Bomb. Nat. Hist. Soc., Bombay. 263 pp.

Prakash,I. 1962. Ecology of the gerbille of Rajasthan desert, India. Mammalia, 26(3): 311-331.

PROJECT TITLE: Food habits of Mus musculus in the Sugarcane-Wheat-Fodder agrosystem of Faisalabad.

STUDENT:

Name: Samia Mubarik

Degree: M.Sc.

INTRODUCTION:

The house mouse (Mus musculus) is a formadable pest. It is a pest of indoor stored food stuffs as well as of the standing crops in the fields. In indoor situations the mouse infests human dwellings, shops, farm houses and a variety of other structures both in urban and rural areas (Ali, 1990, Kha, 1990, Mushtaq-ul-Hassan per.comm.) . The outdoor segment of the mouse's population affects and plunders a wide variety of agricultural crops (Khan, 1989).

In the croplands of central Punjab, seems to have become numerically superior to other species of rodents which infests the croplands (Khan, 1989). In spite of its small size it could be an important pest by

virtue of its bigger population provided it exploits the food crops intensively to fulfil its dietary requirements.

OBJECTIVES:

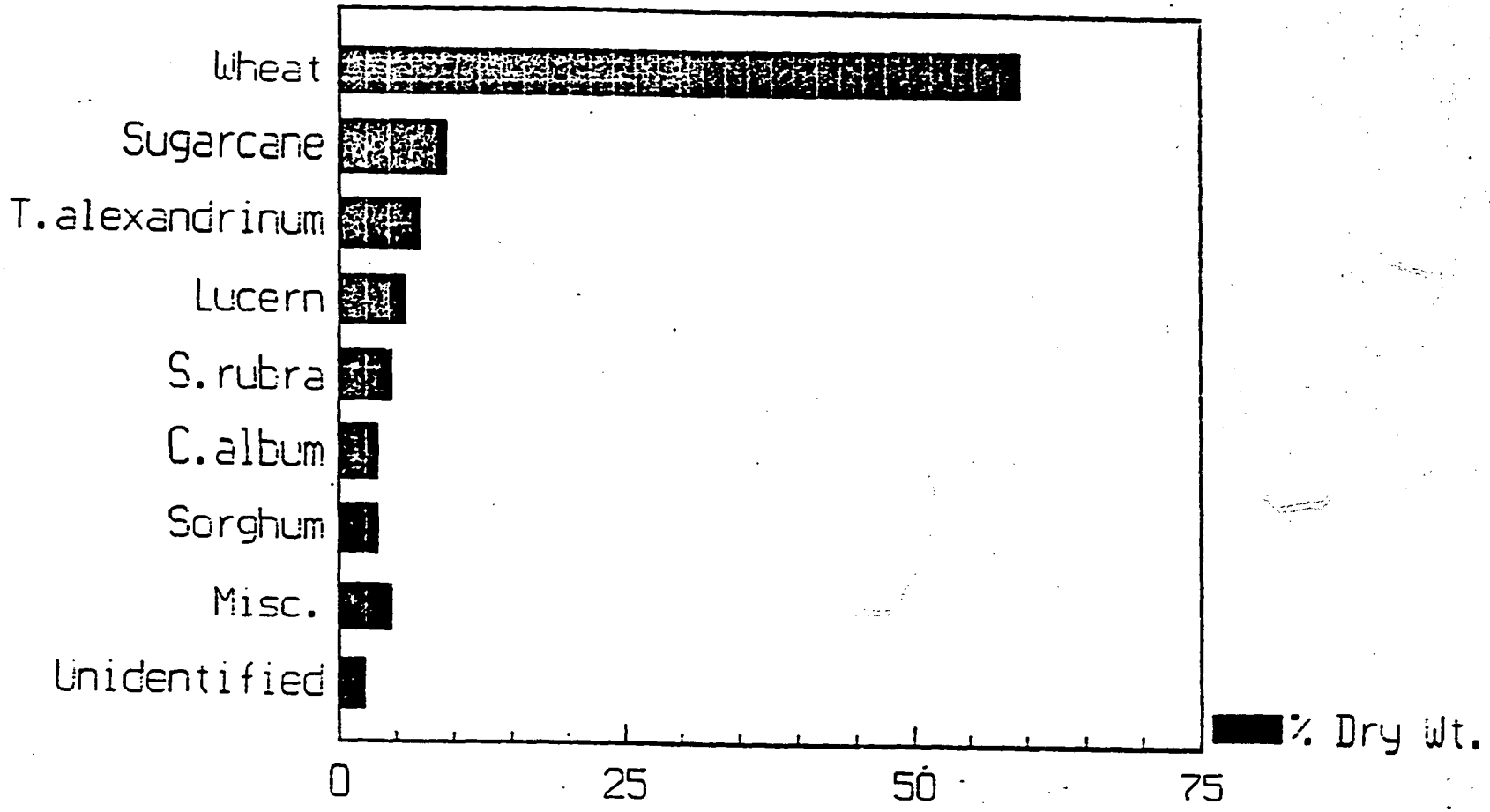
To about the food habits of the mice caught from the croplands of central Punjab.

ACCOMPLISHMENTS:

A total of 355 specimens was snap trapped from wheat, sugarcane, vegetable, cotton, fodder and maize fields of central Punjab during the period extending from August, 1988 through March, 1990. The contents of the stomach of each of these mice were examined under a microscope for comparison and identification of the food particles. The mice were found exploiting 23 different species of plants for their food.

Wheat accounted for 59.30% of the total dry weight of the annual diet of the mouse. Sugarcane (9.30%), Trifolium alexandrinum (6.97%), and lucern (5.81%) were the other important components of the diet of the mice. Spergula rubra (4.65%), Chenopodium murale (1.16%),

Fig.1 Dry weight of various food items in the diet of M.musculus.



maize (1.16%), Portulacia oleracea (2.32%), Chenopodium album (3.40%), and sorghum (3.40%), were eaten in relatively small quantities (Fig. 1). Animal matter was utilized by mouse in only traces. Unidentified food items contributed 2.23% of the total dry weight of the diet.

During the summer season, 14 species of plants were used as food. Of these, wheat (55.84%), sugarcane(9.09%), Spergula rubra (6.49%), lucern (7.74%), and T. alexandrinum (5.19%) were prominant items. During the fall, wheat (50.66%), sugarcane (9.33%), C. album (5.33%), sorghum (5.33%), T. alexandrinum (5.33%) and Spergula (6.60%) were the main items of the diet. Winter diet comprised of the same items but in somwhat different proportions; wheat (62.99%), sugarcane (19.68%), lucern (2.36%), T. alexandrinum (4.72%), Spergula (2.26%), and sorghum (1.57%) being the chief contributors. In the spring, wheat (65.68%) was intensively eaten. T. alexandrinum (10.78%), lucern (6.28%), P.olecacea (4.90%), C. album (1.96%), sorghum (1.96%), and sugarcane (1.96%) were among the other important components of the diet of the mice.

The mice caught from the wheat fields mainly fed on wheat (74.76%). T. alexandrinum (6.54%), lucern(5.6%), P. oleracea (5.6%), C. album (1.86%) and sorghum (1.86%) were the other important components of the diet. The mice captured from sugarcane fields ate wheat (49.37%), and sugarcane (25.92%) intensively; C. album (2.46%), sorghum (3.70%), lucern (4.98%), E. colerum (1.23%), Spergula T. alexandrinum (3.70%), and rice (1.23%) being the other important items in their diet. Mice from the vegetable fields had a relatively more varied diet as in addition to wheat (52.77%) they exploited sugarcane (12.50%), Spergula (8.34%), T. alexandrinum (8.33%), sorghum (6.94%) and C. alba (5.55%) evenly. The mice from the fodder fields depended largely on wheat (62.33%), lucern (7.40%), and T. alexandrinum (9.25%) for their food. The mice living in the cotton fields had relatively more varied diet. Threee items, namely, wheat (52.11%), C. album (9.85%), and Spergula (10.25%) were the major items, whereas lucern (2.56%), sorghum (4.27%), sugarcane (2.56%) and T. alexandrinum (2.56%) were consumed in small quantities.

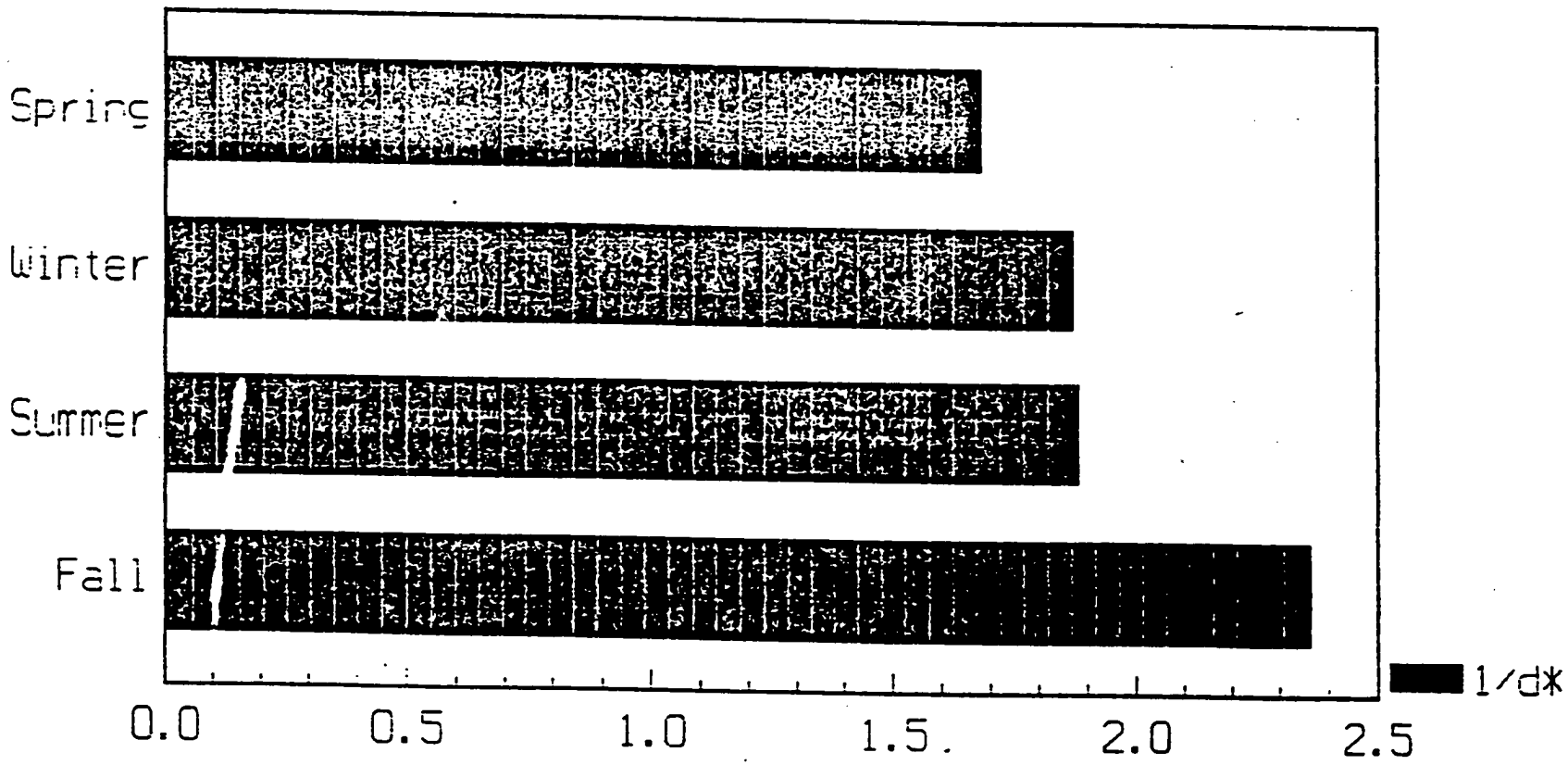
In mice from maize fields, wheat (60.29%), maize (14.70%), and coriander (5.80%) were the staple foods.

Of the four major types of plant tissues seeds were consumed most intensively as they accounted for 58.33% of the total dry weight of the annual diet. Stems, leafs, and roots costituted 27.00%, 10.04%, and 2.00% of the total weight, respectively (Fig. 2).

The floral diversity in the diet of the mouse was assessed using Berger - Parker index. The fall diet was more varied as compared to those of the summer and winter diets. In the spring the diet was the least varied one (Fig. 3).

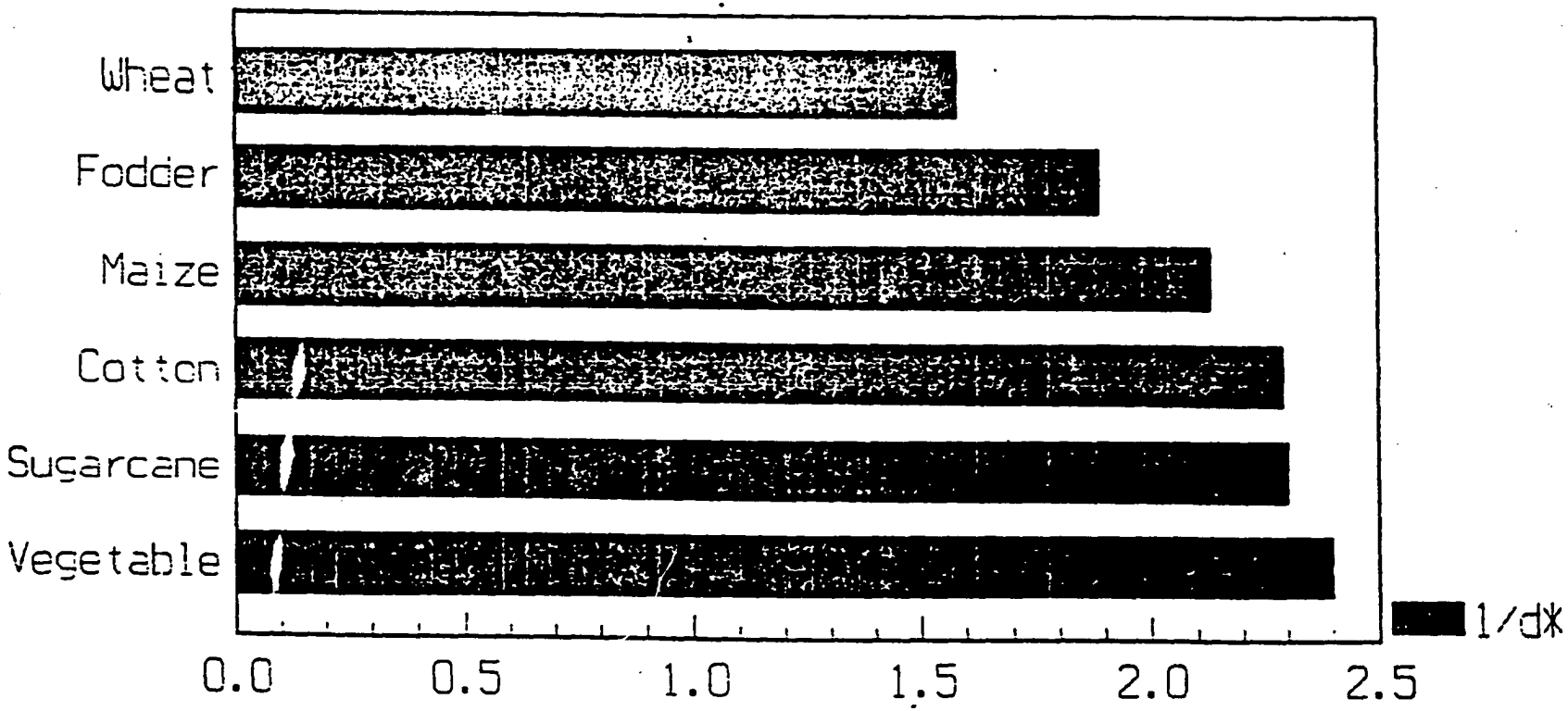
When the diet of the mice was considered according to the habitat of their captured, it was found that the mice captured from the vegetable fields had most varied diet, those from sugarcane and cotton fields had less varied diet, those from maize and fodder had even less varied diet, and those which came from the wheat fields

Fig.2 Dominance index (Berger-Parker index) for seasonal samples of stomach contents of M.musculus.



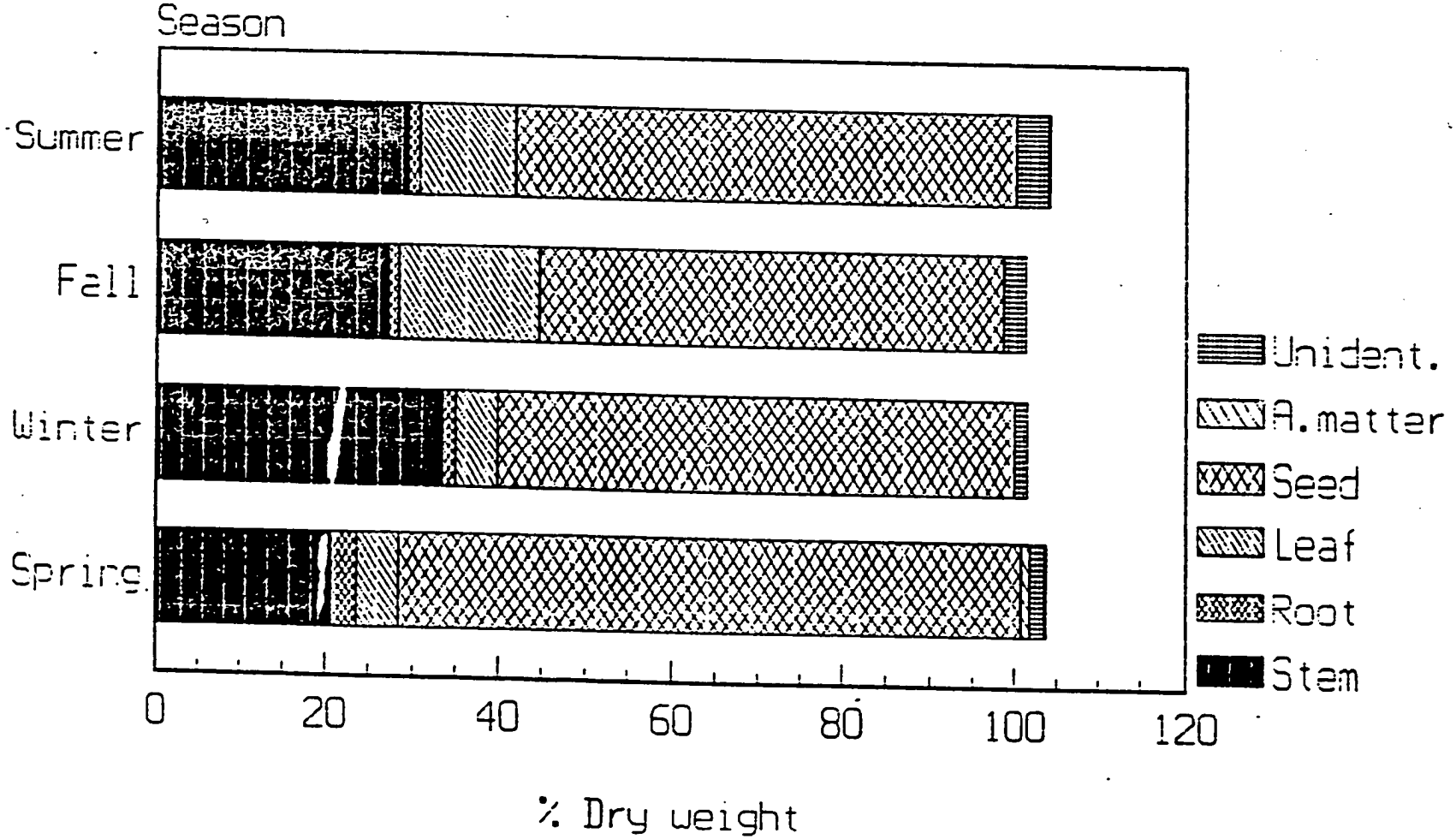
* Reciprocal of Berger-Parker index.

Fig.3 Dominance index (Berger-Parker index) for stomach contents of M.musculus captured from different habitats.



* Reciprocal of Berger-Parker index.

Fig. 4 Proportion of different parts of plants in the diet of Mus musculus.



had the least varied diet (Fig. 4).

Ali, A. 1990. Population density and reproduction in house rat (Rattus rattus) living in residential houses and grain shops af Faisalabad city. M.Sc. thesis, Deptt.of Zoology & Fisheries,Univ.of Agri., Faisalabad.

Khan,A.A. 1990. Population density and reproduction in house rat (Rattus rattus) living in grocer's shops and sweet shops of Faisalabad city. M.Sc. thesis,Deptt.of Zoology & Fisheries,Univ.of Agri., Faisalabad.

Khan,H. 1989. Movement patterns and seasonal changes in abundance of Mus musculus in canal irrigated farmlands. M.Sc. thesis, Deptt.of Zoology & Fisheries,Univ.of Agri., Faisalabad.