



International Journal of
**Zoological
Research**

ISSN 1811-9778



Academic
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**An Observation on the Reproductive Biology of *Glis glis* (Linnaeus, 1766)
(Rodentia; Gliridae) and Body Weight Gaining of Pups in the Istranca
Mountains of Turkish Thrace**

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Abstract: In this study, reproductive biology of *Glis glis* (Linnaeus, 1766) and weight gaining of pups were studied in four localities by using wooden nestboxes and tattoo pliers method in mixed deciduous forest of Istranca Mountains in Turkish Thrace. By considering morphological peculiarities, body weight gaining and reproductive signs of adults, mating behaviors and breeding times were measured from specimens captured in nestboxes. Results showed that females were mated between June 15 and August 18 and gave a birth between July 14 and September 16. The litter size ranged from 1 to 12 (Mean 6.05, n = 100) and the least weight of newborn is 2 g. Female to male ratio were in the range of 48.2 to 51.8%, respectively (n = 82). Over wintering adult yearlings reached maturity in mid June. Yearlings arising hibernation after May gained weight during September and October and they entered hibernation at the end of November. The litters at birth gained weight daily from 0.83-1.19 g and reached to 25.16-35.7 g at mean within 30 days during August and September.

Key words: *Glis glis* (Linnaeus, 1766), fat dormouse, breeding, tattoo pliers, gaining weight, Istranca mountain, Thrace, Turkey

Introduction

The fat dormouse *Glis glis* (Linnaeus, 1766) is an arboreal and nocturnal glirid species inhabited in deciduous forest of Europe, Northern Anatolia, the Caucasus and North-Eastern Iran (Corbet, 1978; Storch, 1978).

In Turkey, it has been reported from Thrace by Kahmann (1962), Dođramaci and Tez (1991), Kurtonur (1975), Kurtonur (1992) Civitelli *et al.* (1995) and Simson *et al.* (1995) and Northern Anatolia (Osborn, 1965; Kumerlove, 1975; Kock, 1990; olak *et al.*, 1994, 1997). Among these records only the paper of olak *et al.* (1997) contains the reproductive knowledge of the fat dormouse. They describe the postnatal development of 8 pups born from a captive female obtained from Rize, North- Eastern Anatolia and give the litter size as 3-8 (Mean: 5.7, n:8).

So, there is no available information on the reproductive biology of the fat dormouse living in Turkish Thrace. The aim of this study was to summarize the reproductive data collected over five years (1998-2002) by monthly checks of 216 nestboxes, which placed in deciduous forest of Istranca (Yildiz) Mountains of Turkish Thrace.

Materials and Methods

Data of breeding *Glis glis* were collected four study areas chosen in the mixed deciduous forest of North-East Turkish Thrace. The name, altitude, latitude, area, number of nestboxes, dominated trees and durations of the monthly controls of the study areas as follows:

- 1 Demirköy. 530 m a.s.l. 41 48 N 27 44 E. 2 ha 60 nestboxes. *Fagus orientalis*, July 1998 - October 2002.
- 2 Çakmaktepe. 130 m a.s.l. 41 48 N 27 46 E. 1.2 ha. 37 nestboxes. *Malus sylvestris*, *Corylus avellanarius*, July 1998 - December 2000.
- 3 Kastro. 10 m a.s.l. 41 36 N 28 06 E. 1.5 ha. 48 nestboxes *Quercus* spp. July 1998 - November 2001.
- 4 Çilingöz. 30 m a.s.l. 41 34 N 28 10 E. 2.4 ha 71 nestboxes, *Quercus* spp., July 1998 - December 2000.

In total, 216 wooden nestboxes (20x18x14 cm, hole 5 cm) were tied to tree trunk according to Morris *et al.* (1990). Nestboxes density was 30 per ha. They were sited 3 - 4 m above the ground.

In total, 891 fat dormice have been captured of which 531 marked by ear tattooing (tattoo pliers). Captured dormice after etherized were weighted, sexed, external measurements (head and body, tail, ear and hind foot) and breeding conditions were recorded.

Female with litters, sizes of litters, sex ratio, weight, external measurements (head and body and tail length) and morphological development (separations of digits, fur development, eye and ear opening) of the nestling were recorded.

In estimation of the mating day and the day of birth of young, the procedures of Bieber's (1998) were followed. The age and from hence, birth date of the young was calculated by their external measurements, morphological development and body weight according to Koenig (1960), Vietinghoff-Riesch (1960), Gaisler *et al.* (1976). In calculation of the mating date, 30-31 days of pregnancy was taken by Koenig (1960).

Results

Breeding Time

During the study, in total, 531 fat dormice were marked in 891 captures. In these animals 88 females with litters have been recorded of which 22 have been recaptured. In certain years, lacking of the females with litters shows that reproduction does not occur in same pattern in every year (Table 1). In the monthly checking period, we observed progress in the morphological sexual characters of both males and females after May 13.

The dates of females with litters that found in the nestboxes in the whole study areas were between 9 August and 25 September. Estimated dates of birth of these nestlings, by using their morphological parameters and body weights, were scattered 14 July and 16 September (Table 2). Within this period, most breeding occurs in the last week of July (36% of all litters recorded) and in the first week of August (24%) (Fig. 1). The mating period can be estimated from the dates of birth minus duration of pregnancy (30-31 days) Koenig (1960). In this case, mating occur between 15 June and 18 August, mostly in the last week of June and first week of July (Table 2 and Fig. 1).

Table 1: Durations of monthly checks of four study areas and the numbers of captured = marked + recaptured fat dormice in which the numbers of females with litters ($\sigma+\text{♀}$) given in parenthesis

Localities	1998 (July-Dec)	1999 (Feb-Dec)	2000 (March-Dec)	2001 (April-Nov)	2002 (May-Oct)	Total
Demirköy	2+0=2 (0)	62+25=87 (9+1=10)	78+58=136 (12+1=13)	92+61=136 (15+8=23)	35+62=97 (0)	269+206=475 (36+10=46)
Çakmaktepe	14+0=14 (4+1=5)	7+0=7 (0)	2+1=3 (0)	-	-	23+1=24 (4+1=5)
Kastro	30+6=36 (4+2=6)	16+18=34 (0)	47+36=83 (11+2=13)	32+59=91 (15+5=20)	-	125+119=244 (30+9=39)
Çilingöz	52+13=65 (8+1=9)	39+16=55 (6+1=7)	23+5=28 (4)	-	-	114+34=148 (18+2=20)
Total	98+19=117 (16+4=20)	124+59=183 (15+2=17)	150+100=250 (27+3=30)	124+120=244 (30+13=43)	35+62=97 (0)	531+360=891 (88+22=110)

$\sigma + \text{♀}$ (male and female symbols)

Table 2: Estimated birth and mating dates of females with pups in Istranca Mountains

Localities	Captured date	No.	Litter size	Mean body weight	Estimated Age (days)	Estimated birth date	Estimated mating date
Demirköy 2 ha	25/08/1999	9	4-7	30-40	28-42	14-28 July	15-29 June
	29/08/2000	12	3-10	16-42	20-45	16 July-10 Aug	17 June-12 July
	09/08/2001	15	1-8	4-20	3-22	18 July-06 Aug	19 June-08 July
Çakmaktepe 1.2 ha	21/08/1998	2	5-6	5-19	6-22	14 July - 10 Aug	15 June - 12 July
	21/09/1998	2	5-7	8-32	10-35	02-15 Aug	04-17 July
						15 Aug-11 Sept	04 July - 13 Aug
Kastro 1.5 ha	22/08/1998	3	6-8	4-8	7-10	02 Aug - 11 Sept	14-21 July
	21/09/1998	1	6	32	36	12-19 Aug	18 July
	29/08/2000	7	5-8	2-32	1-36	16 Aug	25 June-30 July
	23/09/2000	4	6-8	6-19	7-20	24 July-28 August	05-18 Aug
	09/08/2001	10	4-8	2-12	3-13	3-16 September	28 June-10 July
	07/09/2001	5	4-8	20-34	32-37	27 July-08 Aug	03-08 July
Çilingöz 2.4 ha	21/08/1998	3	6-8	12-14	12-28	01-06 Aug	25 June-18 Aug
	22/09/1998	5	3-6	7-44	12-40	24 July - 16 Sept	25 June-11 July
	25/08/1999	4	6-8	5-7	7-8	24 July-09 Aug	06 July-12 Aug
	25/09/1999	2	6-6	28-30	30-30	04 Aug-10 Sept	19-20 July
	29/08/2000	4	1-12	5-18	6-23	17-18 Aug	27-28 July
Total = 7.1 ha		88	1-12			9-23 Aug	11 July-25 July
						24 July - 10 Sept	25 June-12 Aug
						14 July - 16 Sept	15 June - 18 Aug

Table 3: Litter sizes and sex ratios of pups

Locality	Litter sizes			Sex ratio		
	n	Min - Max	Mean	n	(%) σ	(%) ♀
Demirköy	36	1-10	6.1	251	61.7	38.3
Çakmaktepe	4	5-7	5.7	23	56.5	43.5
Kastro	31	4-8	6.2	166	53.6	46.4
Çilingöz	18	1-12	6.1	90	53.3	46.7
Total	89	1-12	6.1	556	54.1	45.9

The unproductive year in Demirköy, that is 2000 and the unfruiting beech trees confirm the notion of Bieber (1998) that *Glis glis* foresee the time that the trees around will not give fruit and thus they don't breed.

Litter Sizes and Sex Ratio

Total litter size varied between 1 and 12 (mean = 6.1, N = 90) (Table 3). Litters of 5-8 young were most frequent (75% of all litters recorded) (Fig. 2). At all study areas the average proportion

Table 4: The body weight gaining of captured and recaptured pups in August, September and October 1998 and 2001 (n = 25). (*) = New born

Locality	Captured date and weight (g)	Age (days)	Daily body weight gaining (g)	Recaptured date and weight (g)	Age (days)	Gaining weight(g)	Daily body weight gaining (g)
Demirköy	25 Aug 1999-38	32	1.18	15 Sept 1999-78	21	40	1.90
	29 Aug 2000-8.6	21	0.88	22 Sept 2000-4.6	25	26	1.04
	07 Sept 2001-36	32	1.22	04 Oct 2001-90	28	54	1.92
	09 Aug 2001-12	12	0.92	07 Sept 2001-6.2	30	34.2	1.14
	09 Aug 2001-20	22	0.90	07 Sept 2001-61.3	30	41.3	1.37
	09 Aug 2001-10	12	0.83	07 Sept 2001-51.3	30	41.3	1.37
	09 Aug 2001-14	15	0.93	07 Sept 2001-44	30	30	1
	09 Aug 2001-10	12	0.83	07 Sept 2001-4.6	30	34.6	1.15
	09 Aug 2001-10	12	0.83	07 Sept 2001-4.6	30	34.6	1.15
	09 Aug 2001-10	12	0.83	04 Oct 2001-113	56	103	1.83
Kastro	09 Aug 2001-10	12	0.83	04 Oct 2001-92	56	82	1.46
	29 Aug 2000-32	31	1.03	23 Sept 2000-69	26	37	1.42
	29 Aug 2000-2 (*)	1		23 Sept 2000-22.5	26	20.5	0.78
	07 Sept 2001-33	36	0.91	04 Oct 2001-66	28	33	1.17
	07 Sept 2001-26	34	0.76	04 Oct 2001-71	28	45	1.60
	07 Sept 2001-31	33	0.93	04 Oct 2001-64	28	33	1.17
	09 Aug 2001-12	13	0.92	07 Sept 2000-4.6	30	32.6	1.08
	09 Aug 2001-4.5	5	0.90	07 Sept 2001-26	30	21.5	0.71
	09 Aug 2001-5	6	0.83	07 Sept 2001-23.4	30	18.4	0.61
	09 Aug 2001-4	5	0.80	07 Sept 2001- 31	30	27	0.90
	09 Aug 2001- 8	10	0.80	07 Sept 2001-24.3	30	16.3	0.54
	22 Aug 1998-4	3	1.33	21 Sept 1998-3.8	32	29.8	0.93
	22 Aug 1998-6	7	0.85	21 Sept 1998-32	32	26	0.81
Çilingöz	22 Aug 1998-12	13	0.92	21 Sept 1998-30	32	18	0.56
	24 Aug 1999-5.8	5	1.16	25 Sept 1999-30	33	24.2	0.73

Table 5: The first breeding ages of the female that marked when yearlings and recaptured in the following year with litters (n=14)

Marked date and (body weight)	Daily body weight gains	Approximate (age) and date of birth	Recaptured date and (body weight)	Litters sizes and (mean body weight) with recaptured females	Approximate birth day of litter with recaptured females	Approximate age of first delivery than birthday
21 Sept 1998 (44 g)	1.04 g	(42 days) 10 Aug	29 Aug 1999 (148 g)	3♂+3♀ (20 g)	(20 days) 04 Aug	361 days
21 Sept 1998 (44 g)	1.04 g	(42 days) 10 Aug	24 Aug 1999 (112 g)	6♂ (6.3 g)	(8 days) 18 Aug	368 days
24 Oct 1998 (80 g)	1.25 g	(64 days) 21 Aug	24 Aug 1999 (102 g)	4♂+4♀ (5.8 g)	(7 days) 17 Aug	371 days
24 Oct 1999 (80 g)	1.25 g	(64 days) 21 Aug	29 Aug 2000 (110 g)	4♂+8♀ (12 g)	(12 days) 18 Aug	372 days
29 Aug 2000 (48 g)	1.06 g	(45 days) 13 July	09 Aug 2001 (142 g)	2♂+3♀ (10 g)	(12 days) 28 Aug	380 days
29 Aug 2000 (46 g)	1.04 g	(44 days) 14 July	09 Aug 2001 (148 g)	3♂+1♀ (14 g)	(15 days) 25 July	376 days
21 Sept 2000 (66 g)	1.10 g	(60 days) 24 July	09 Aug 2001 (122 g)	3♂+4♀ (10 g)	(15 days) 28 July	369 days
21 Sept 1999 (94 g)	1.42 g	(66 days) 22 July	29 Aug 2000 (138 g)	4♂+3♀ (23 g)	(28 days) 01 Aug	375 days
21 Sept 2000 (72 g)	1.18 g	(61 days) 24 July	09 Aug 2001 (124 g)	5♂+1♀ (10 g)	(12 days) 28 July	369 days
21 Sept 2000 (58 g)	1.05 g	(55 days) 30 July	07 Sept 2001 (120 g)	3♂+2♀ (34.4 g)	(37 days) 01 Aug	367 days
21 Sept 2000 (54 g)	1.05 g	(51 days) 04 Aug	09 Aug 2001 (124 g)	2♂+5♀ (4.5 g)	(5 days) 04 Aug	365 days
21 Sept 2000 (70 g)	1.18 g	(59 days) 25 July	09 Aug 2001 (116 g)	6♂+2♀ (4 g)	(3 days) 06 Aug	377 days
21 Sept 2000 (68 g)	1.17 g	(58 days) 27 July	09 Aug 2001 (116 g)	4♂+4♀ (5 g)	(6 days) 03 Aug	372 days
25 Oct 2000 (76 g)	1.22 g	(62 days) 24 Aug	07 Sept 2001 (102 g)	3♂+1♀ (24 g)	(24 days) 10 Aug	351 days
Average =	1.04-1.42 g					351-380 days
Mean =	1.14 g					371 days

of the males among the litters were significantly male based. In the whole sample the proportion of males was 54.1%. There is no statistically significant difference between the sex ratios of the pups in all four localities (ANOVA df 3 p>0.05) (Table 3).

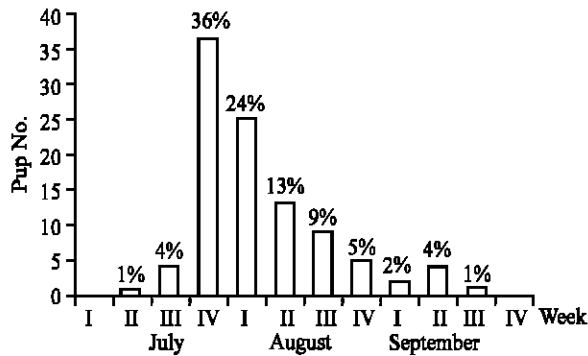


Fig. 1: Weekly distributions of birth rate frequencies and pup numbers

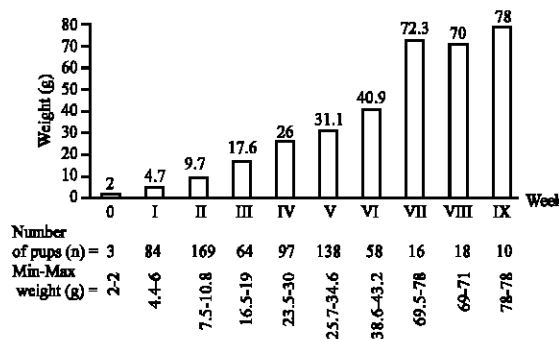


Fig. 2: Weekly weight gains of the pups after birth

Body Weight Gaining of the Young

The pups weigh 2 g at birth. The newborns reached a body weight of 20 g by the 26th day of their lives, gaining about 0.78 g a day. During this study, we found that the pups were 1-36 days old when they were first observed in the next boxes and that their daily weight gains was 0.76-1.22 g with an average of 0.93 g (n = 25). The same pups were 21-56 days old when they were caught for the second time. They increased their weights by 18-82 g since the first observation and their daily weight gains was 0.54-1.92 g (Table 4).

All the pups' body weight gains were tracked weekly till the 9th week and their average weights were found to reach 78 g (Fig. 2) The average weekly and daily weight gains of the pups were 8.6 and 1.2 g, respectively.

Table 5 shows that the daily body weight gains of the marked pups were 1.04-1.42 g with a mean of 1.14 g.

The weight gains of both adults and pups were at the highest levels in September, October and November due to fat deposition as preparation for hibernation. Adults and pups continued to use the next boxes until 20th of November. The individual with the highest body weight was caught on 4th of October with 286 g.

First Delivery of Young Females

The pups caught in the nestboxes during our controls were marked if they weighed 40 g or more. The female individuals among them were recaptured in the following year with their pups. The females gave birth after 351-380 days. The ones that gave their first births were observed to perform this task when they reached to a body weight of 102 g (Table 5).

Acknowledgements

I thank to Prof. Dr. Cengiz Kurtonur, Tansel Türkyılmaz and Sinan Çınarkök for their contributions to the manuscript and their kind helps for the long field study. This study was supported by The Scientific Research Fund of Trakya University (Project No. TUBAP-171).

References

- Bieber, C., 1998. Population dynamics, sexual activity and reproduction failure in the fat dormouse (*Myoxus glis*). J. Zool., Lond., 244: 223-229.
- Civitelli, M.V., M.G. Filippucci, C. Kurtonur, B. Özkan and E. Capauna, 1995. Chromosome Analysis of Three Species of Myoxidae. In: Filippucci M.g. (Ed.). Proc. II Conf. Dormice. Hystrix. (N.s.) 6: 117-126.
- Çolak, E., N. Yiğit and R. Verimli, 1994. Periodic Cycles in Food Intake and Body Weight of Juvenile Dormice *Glis glis orientalis* (Nehring, 1903) (Rodentia: Gliridae), in Northern Anatolia. Tr. J. Zool., 18: 241-244.
- Çolak, E., N. Yiğit, E. Kivanç and M. Sözen, 1997. Türkiye'deki *Glis glis orientalis* (Nehring, 1903) (Rodentia: Gliridae)'in Üreme Biyolojisi [Reproductive Biology of *Glis glis orientalis* (Nehring, 1903) (Rodentia: Gliridae) in Turkey]. Doğa. Tr. J. Zool., 21: 375-380.
- Corbet, C.B., 1978. The Mammals of The Palaearctic Region: A Taxonomic Review. Cornell University Press. London and Ithaca, pp: 314.
- Doğramacı, S. and Ç. Tez, 1991. Türkiye *Glis glis* (Mammalia: Rodentia) Türünün Coğrafik Varyasyonları ve Karyolojik Özellikleri [Geographic variations and karyological characteristics of the Species *Glis glis* (Mammalia: Rodentia) in Turkey]. Doğa Tr. J. Zool., 15: 275-288.
- Gaisler, J.H. and M. Homolka, 1976. Ecology and reproduction of Gliridae (Mammalia) in northern Moravia. Folia Zool., 26: 213-228.
- Kahmann, H., 1962. Neue Ergebnisse in der Säugetierforschung in der Türkei [New results in researches of mammals living in Turkey]. Säugetierkd. Mitt., München, 10: 112-116.
- Koenig, L., 1960. Das Aktionssystem des Siebenschläfer (*Glis glis* L.) [The Aktionssystem of the Edible Dormice (*Glis glis* L.)]. Zeitschrift für Tierphysiologie, Band 17: 427-505.
- Kock, D., 1990. Notes on mammals (Insectivora, Rodentia) taken by the tawny owl, *Strix aluco*, in NW Turkey. Zool. Middle East, Heidelberg, 4: 5-9.
- Kumerloève, H., 1975. Die Säugetiere (Mammalia) der Türkei [Mammals (Mammalia) in Turkey]. Veröff. Zool. Staatssammlung München., 18: 69-158.
- Kurtonur, C., 1992. First specimens of *Glis glis* (Linneus, 1776) from Turkish Thrace (Mammalia; Rodentia; Gliridae). Senckenbergiana Biol., 71: 1-6.
- Kurtonur, C., 1975. New Records of Thracian Mammals. Säugetierk. Mitt., München, 23: 14-16.

- Morris, P.A., P.W. Bright and D. Woods, 1990. Use of nestboxes by the dormouse *Muscardinus avellanarius*. *Biol. Conserv.*, 51: 1-13.
- Osborn, D.J., 1965. The hare, porcupine, beaver, squirrels, jerboas and dormice of Turkey. *Mammalia*, Paris., 28: 573-592.
- Simson, S., L. Ferrucci, C. Kurtonur, B. Özkan and M.G. Filippucci, 1995. Phalli and Bacula of European Dormice: Description and Comparison In: Filippucci M.g., (Ed.). Proc. II Conf. On Dormice. *Hystrix*. (N.s.) 6:231-244.
- Storch, G., 1978. Gliridae. In: Niethammer, J. And F. Krapp (Eds.), *Handbuch Der Säugetiere Europa*, Band 1, Rodentia I. [Handbook of European Mammals, Vol. 1, Rodentia I.]. Wiesbaden, Akademische Verlagsgesellschaft, pp: 201-280.
- Vietinghoff-Riesch, W.A. Frhr. v., 1960. Der Siebenschläfer (*Glis glis* L.). [The edible dormouse (*Glis glis* L.) Monographien der Wildsäugetiere Band XIV, Jena.