

# Lipid content of migrant red admirals (*Vanessa atalanta* L.) in Denmark in autumn 1998.

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Lipid content of 284 migrating red admirals caught in Denmark during the autumn of 1998 was determined. Only butterflies caught during August and the beginning of September had lipid stores that could sustain active, flapping flight for more than a few hours. Many recently emerged butterflies were also found to be lipid depleted during this period. In general, during September, the lipid reserves of all red admirals declined dramatically due to extremely poor weather conditions, which did not allow the butterflies to feed and migrate. The data indicate that most red admirals starved to death in N Europe in 1998.

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## Introduction

The red admiral is a widely distributed butterfly, which performs regular seasonal migrations. During the spring in the West Palearctic the species undertakes a two-step migration from the Mediterranean towards northern Europe where it normally completes one summer generation. In very warm years a partial second generation can be produced. The species is not capable of surviving the winter in northern Europe and has to migrate to SW Europe and the Mediterranean in autumn (Emmet & Heath 1990). Such regular, southward migrations have been observed in all parts of Europe, from Norway (Lid, 1977) to Italy (Benvenuti et al., 1994, 1996).

During early autumn the red admirals accumulate lipid reserves for the migratory flight. To investigate the extent of lipid accumulation and depletion during the migratory period, I examined the lipid content of 284 migrant red admirals in autumn 1998. The butterflies were hand-netted at the coastline of Vejle Fjord, E Jutland, where migrating butterflies aggregate until crossing the water.

The lipid extraction procedure followed the method described by Folch et al. (1957) with the modifications of Ways and Hanahan (1964). All butterflies were sexed, and dry weight, lipid weight and wingspan were recorded. To correct for the size of the butterflies, all statistics on lipids were computed on lipid mass in percent of total dry mass.

## Results and discussion

Lipid mass is shown in figure 1, while all other data have been summarised in table 1. Lipid content was not normally distributed (Kolmogorov-Smirnov test), but a log-transformation yielded normally distributed data for each sex and date. The wingspan of male and female butterflies differed significantly, but lipid content was independent of sex. Lipid content reached its highest levels in the beginning of the season.

The low lipid levels found in late August probably reflect a strong representation of

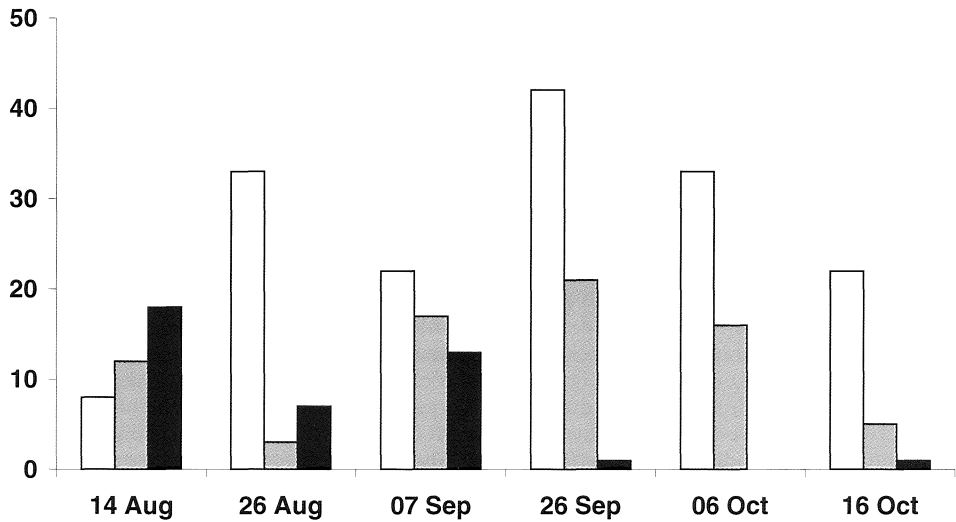


Figure 1. Lipid mass of red admirals caught on six days during autumn 1998. White: low (<20 mg); Shaded: intermediate (20-40 mg); Black: high (>40 mg).

recently emerged butterflies, but after a period of continuous feeding, lipid stores of some migrant red admirals reached 120 mg or 50% of the total dry weight of the butterfly. According to the lipid consumption scheme of Zebe (1954), this may sustain the active, flapping flight of the closely related peacock butterfly (*Inachis io*) for 20 hours, corresponding to at least 3-400 kilometres. Only butterflies in the beginning of the season had lipid stores sufficient for a flight of this magnitude. From late September most butterflies were extremely lipid depleted, with lipid stores sufficient for only a few hours of migration!

The autumn of 1998 was very cold, and in September there were only five days with sunshine and calm winds. Hence, the majority of red admirals, which had low lipid stores in early September, were forced to await optimal conditions for foraging. As starving butterflies do not migrate, migration was delayed and eventually postponed, and all

date variable	14 Aug	26 Aug	7 Sep	26 Sep	6 Oct	16 Oct
N males	22	21	25	29	32	17
mean wing length ± SEM	3,15 ± 0,02	3,09 ± 0,02	3,12 ± 0,02	3,08 ± 0,02	3,10 ± 0,03	3,06 ± 0,03
N females	16	27	27	37	20	11
mean wing length ± SEM	3,28 ± 0,04	3,24 ± 0,02	3,21 ± 0,03	3,23 ± 0,02	3,24 ± 0,02	3,21 ± 0,04
mean lipid content in % of dry mass #	27,0 A	13,6 B	20,8 A	15,2 B	14,8 B	13,3 B
95 % confidence limits: upper bound	31,5	16,0	24,4	17,0	16,7	16,0
lower bound	23,2	11,5	17,7	13,7	13,0	11,1

# A and B are significantly different from each other (Hochberg GT2-test,  $p < 0,05$ ).

Table 1. Wing length of right wing and lipid content of male and female red admirals during autumn 1998.

butterflies must have died during October. However, September 1999 was very hot and sunny, and the red admirals had plenty of time to forage. Migrations peaked on 22 September, when millions of well-fed red admirals migrated south over Denmark (pers. observations). This migratory front probably reached the Alps mid October (Christian Fregat in litt.), and contrary to 1998 many butterflies may actually have succeeded their journey to the overwintering grounds around the Mediterranean.

### Dansk sammendrag

Fedtindholdet hos 284 admiraler, som blev fanget på træk i løbet af efteråret 1998, blev bestemt i laboratoriet. Målingerne viste, at det udelukkende var sommerfugle fanget tidligt i trækperioden, som havde fedtreserver til træk af længere varighed. Der optrådte dog også mange nyforvandlede sommerfugle med meget små fedtreserver i denne periode. Fra slutningen af september havde næsten alle sommerfugle meget begrænsede fedtreserver. September 1998 var meget kold og blæsende, hvilket utvivlsomt betød, at kun sommerfugle, som på forhånd havde meget store fedtreserver, kunne udnytte de få gode dage til sydtræk. Resten har i stedet været tvunget til at søge føde, men er alligevel omkommet af sult i løbet af oktober.

### References

- Benvenuti, S., P. Dall'Antonia & P. Ioalé, 1996. Directional preferences in the autumn migration of the Red Admiral (*Vanessa atalanta*). – *Ethology* 102: 177-186.
- Benvenuti, S., P. Dall'Antonia & P. Ioalé, 1994. Migration pattern of the red admiral, *Vanessa atalanta* L., (Lepidoptera, Nymphalidae), in Italy. – *Bolletino di Zoologica* 61: 345-351.
- Emmet, A.M. & J. Heath (eds.), 1990. *The Moths and Butterflies of Great Britain and Ireland*, volume 7, part 1. Hesperidae to Nymphalidae – The Butterflies. Harley Books, Colchester.
- Folch, J., M. Lees & G.H. Sloane-Stanley, 1957. A simple method for the isolation and purification of total lipids from animal tissues. – *Journal of Biological Chemistry* 226: 497-509.
- Lid, 1976. Observationer av admiralen i Norge i 1976. – *Atalanta norvegica* 3: 18-23.
- May, P.G., 1992. Flower selection and the dynamics of lipid reserves in two nectarivorous butterflies. – *Ecology* 73: 2181-2191.
- Ways, P. & D.J. Hanahan, 1964. Characterization and quantification of red cell lipids in normal man. – *Journal of Lipid Research* 5: 318-328.
- Zebe, E., 1954. Über der Stoffwechsel der Lepidopteren. – *Zeitschrift für vergleichende Physiologie* 36: 290-317.