

Ecology and rearing of *Hipparchia statilinus* (HUFNAGEL, 1766) from Mount Faito (Campania, Italy) (Lepidoptera : Nymphalidae, Satyrinae)

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Summary

Investigations on *Hipparchia neapolitana* from Mt. Faito (Campania, I) formed the starting-point for breeding experiments by the first author (D.J.) on *Hipparchia statilinus*, which occurs in the same area, and whose early stages are completely illustrated for the first time. Description of the breeding of *H. statilinus* is completed by a review of the literature on the distribution, biology and ecology of this species, based in particular on the studies of GARCÍA-BARROS (1986, 1989a, 1989b) on *H. statilinus* and *H. semele* and on the descriptions of *H. statilinus* in HESSELBARTH *et al.* (1995, vol. 2 : 909-912).

Résumé

Des recherches sur *Hipparchia neapolitana* au Mte Faito (Campanie, Italie) ont été le départ d'un élevage d'*Hipparchia statilinus* qui se rencontre également au même site, et dont les premiers stades sont présentés pour la première fois en totalité. Le compte rendu d'élevage a été complété par des informations tirées de la littérature concernant la répartition, la biologie, et l'écologie de l'espèce. L'auteur s'appuie tout particulièrement sur les études d'*Hipparchia statilinus* et d'*Hipparchia semele* réalisées par GARCÍA-BARROS (1986, 1989a, 1989b) et les descriptions d'*Hipparchia statilinus* dans HESSELBARTH *et al.* (1995, vol. 2 : 909-912).

Riassunto

Ricerche su *Hipparchia neapolitana* del Monte Faito (Campania, Italia) hanno costituito la base di partenza per un allevamento da parte del primo autore (D.J.) di *Hipparchia statilinus*, presente nella stessa zona e i cui stadi pre-imaginali vengono illustrati completamente per la prima volta. La descrizione dell'allevamento è stata completata da dati sulla distribuzione, biologia ed ecologia della specie, desunti dalla letteratura. In particolar modo si basa sugli studi di GARCÍA-BARROS (1986, 1989a, 1989b) su *H. statilinus* e *H. semele* e sulle descrizioni di *H. statilinus* in HESSELBARTH *et al.* (1995, vol. 2 : 909-912).

Zusammenfassung

Untersuchungen über *Hipparchia neapolitana* am Mte. Faito (Kampanien, I) bildeten den Ausgangspunkt für eine Zucht des Verfassers (D.J.) der dort ebenfalls vorkommenden *Hipparchia statilinus*, deren Präimaginalstadien erstmals vollständig gezeigt werden. Der Zuchtbericht wurde ergänzt mit Informationen zu Verbreitung, Biologie und Ökologie aus der Literatur. In besonderem Masse stützt er sich auf die Studien über *H. statilinus* und *H. semele* von GARCÍA-BARROS (1986, 1989a, 1989b) und auf die Beschreibungen zu *H. statilinus* in HESSELBARTH *et al.* (1995, vol. 2 : 909-912).

Introduction

In 1995, I visited Mount Faito (Campania, Italy) three times in a search for fecundated ♀♀ of *Hipparchia neapolitana* (STAUDER, 1921). During my last visit (28.VIII.1995), the most important area, the barren, south-western slopes of Mt Faito above the village of Massaquano, was populated mainly by ♂♂ of *Hipparchia statilinus*, settled on the bare ground or on the limestone rocks, where they were almost invisible although at almost every step a number were scared up. On this occasion I took a fresh-looking ♀ which was made to oviposit for breeding preimaginal stages in a greenhouse on my balcony in Switzerland.

Breeding

Oviposition : the captured ♀ began to lay in the flight cage on the two following days. 230 eggs were laid up to 10.IX.1995 and several hundreds up to 9.X.1995 (when the ♀ died). Most of the eggs were attached to the muslin netting forming

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the sides, preferably about 1 cm below the top wooden frame on the side exposed to the light. When oviposition had ended I cut the netting with the eggs attached into several pieces which I then inserted between the leaves of potted tufts of *Festuca*.

Description of the egg : the freshly laid egg is whitish, rather elongated in shape, about 1 mm long and 0.75 mm in diameter. Within a week the colour changes to light grey. I counted the longitudinal ribs of 20 eggs. There were 14 with 15 ribs, 5 with 14 and 1 with 16. Transversal ridges were not prominent.

The ♀♀ of *statilinus* mate shortly after emerging (GARCÍA-BARROS, 1989b). ♂♂ can copulate up to three times. Some ♀♀ were found to contain two spermatophores in the bursa, so that *statilinus* can be considered to be polygamous. GARCÍA-BARROS (1989b) counted the eggs of three different ♀♀ of *statilinus* in captivity : Between 421 and 739 eggs were laid. These were attached to the underside of dry blades of grass or leaves of other plants. This stage lasts an average of 10 to 12 days. The ♀♀ of northern populations (e.g. Dutch) seem to lay fewer eggs : BINK (1992 : 411) counted only between 120 and 170 eggs per ♀.

Development of the caterpillar : my caterpillars began to hatch in September. They devoured the egg-shell almost completely and remained close to their birth-place on the muslin netting. If disturbed they arched up the front part of their body and the end of their abdomen, assuming a horse-shoe shaped position, a defensive position I have never before observed in any other larvae of the *Satyrinae*. Fine weather with more than average temperatures prevailed in Effretikon until the end of October 1995. Only a few caterpillars began to feed during this period. At the beginning of November, as the weather became colder and damper, the little caterpillars suddenly left their former position on the netting and began to feed actively. Their colour, up to then brownish, turned to green. By November 11th only very few caterpillars had not yet begun to feed. During the winter months the L1 larvae climbed up the blades of *Festuca* to feed, mainly on sunny days, and remained hidden at the base of the tufts of grass at night. They did not increase in size until early spring.

Percentage of losses : No more than 5% of the initially hatched larvae survived the winter months. This may have been due in the first place to overcrowding of the grass tufts and secondly to competition with the caterpillars of *H. neapolitana*, in a more advanced stage of development, which were reared on the same pots. Another possible

cause could have been a shortage of tender sprouts : at the edge of one pot I noted several seedlings of *Festuca* during November and December. This tender grass excited a more-than-average interest among the young larvae, but unfortunately in the long run did not survive due to drying out of the soil in the pot between waterings.

L2-L6 : The first L2-larvae were noted on 20.III.1996, about 5 months after hatching from the egg. The subsequent moults followed at shorter intervals : third stage larvae were first observed at the end of April, L4 on May 16th, L5 from May 30th and L6 from June 14th.

Activity : In stage L4 the period of activity changed from day to night. L4 caterpillars were observed to feed both during the day and at night. L5 and L6 larvae fed exclusively during the night.

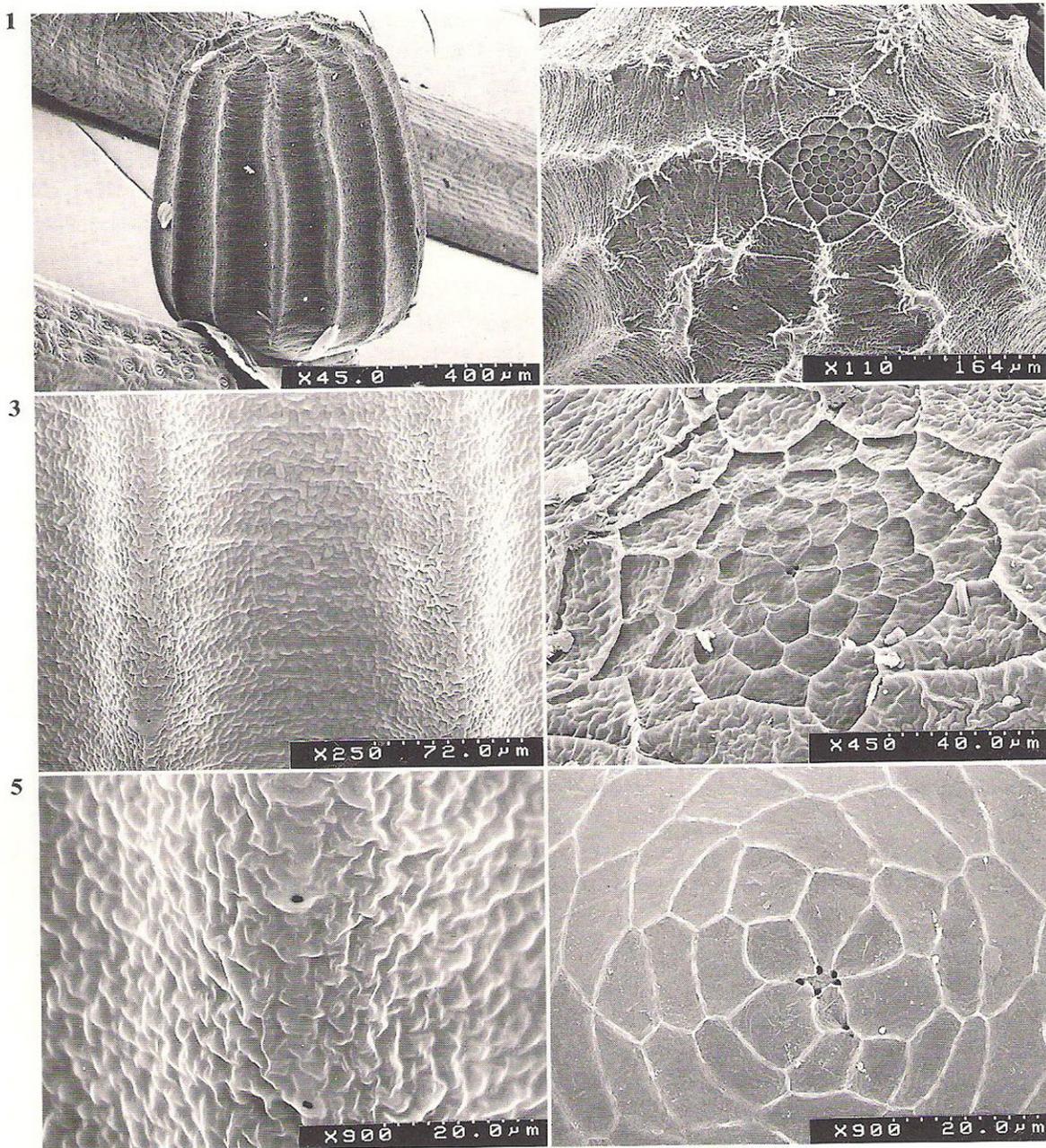
Counts : On May 24th I counted 14 larvae : 4 × L3, 1 × L3/L4, 9 × L4. On July 18th there were 1 × L5 and 11 × L6 larvae, 8 larvae were still observed feeding on July 24th, 6 on August 4th, and one last caterpillar on August 16th.

G. HESSELBARTH (in litt.) reported that larvae of *statilinus* from Dalmatia (Burga, near Hercegnovi) sent to him by N. MEYER-WESTFELD, reared in 1985/86, in the final instar fed mainly twice daily, at about midday and, briefly, shortly after nightfall. The caterpillars climbed up the stalks of the potted foodplant (*Poa annua*), starting to devour the blades from the tip while crawling backwards down the blade.

Description of the caterpillar : L1 : the newly hatched larvae are brown ; the head is light brown spotted with dark brown points. After beginning to feed, from L1 to L4 the ground colour is green. In L5 a reddish-brown lateral band makes its appearance. In L6 the ground colour is brown. In full grown caterpillars the two anal points are strikingly long and there is a broad dark brown dorsal stripe ; in caterpillars from other localities the latter may be dark green in colour, as can be inferred from the illustrations in WEIDEMANN (1988 : 278), LSPN (1987 : 243) and GÓMEZ DE AIZPÚRUA (1991 : 38-40). BINK (1992 : 411) however, figures an adult larva of *statilinus* with a dark brown dorsal stripe as in my series.

Width of head : L1 : 0.5 mm, L2 : 0.75 mm, L3 : 1.25 mm, L4 : 1.8 mm, L5 : 2.8-3 mm, L6 : 4 mm ♂♂ and 4.5 mm ♀♀. Length of L1-larva before starting to feed : 2.5 mm.

Among the *statilinus* caterpillars from Dalmatia bred by G. HESSELBARTH, the colour of the lateral stripe, characteristic of the L5 stage, varied in tone from deep red to pale pink. The bright chestnut



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Figs 1-6 : SEM-photographs of the ovum of *Hipparchia statilinus*.

1 : Ovum, lateral view.
2 : Ovum, top view.

3 : Section of the lateral wall with two longitudinal ribs.
4 : Micropylar area.

5 : Longitudinal rib with 2 pores.
6 : Micropyle.

Photos :
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brown tones of the L6 larvae were more contrasted than in the bred caterpillars from Mount Faito.

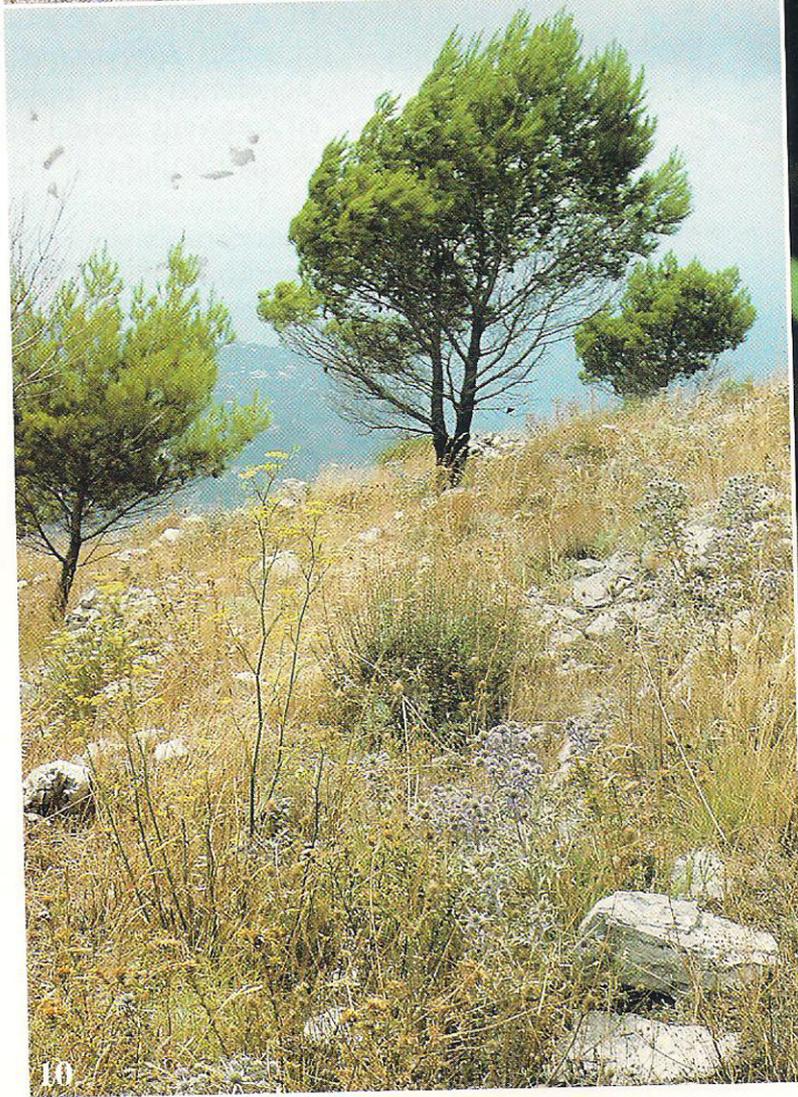
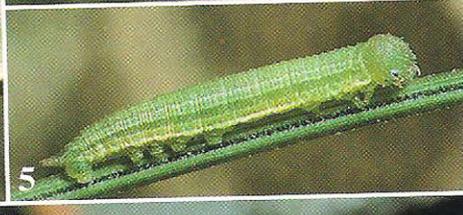
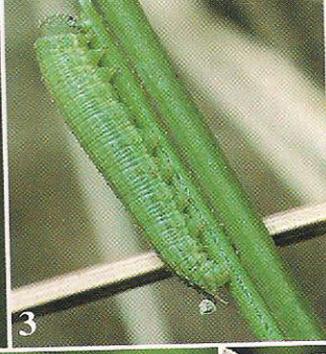
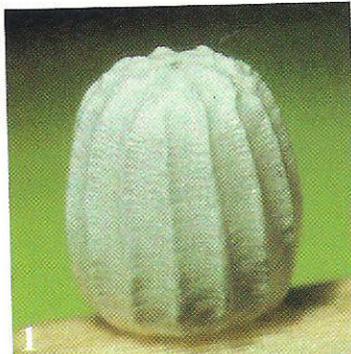
The descriptions of GARCÍA-BARROS (1989b) broadly coincide with my observations, but contain more details and other interesting information. Thus, G.-B. observed a period of 20-40 days in stage L1 in which the larvae showed no interest in feeding. L1 caterpillars that were not removed from the cage could remain without food for up to 80 days. From December to February the caterpillars only fed on warm sunny days. The larvae changed to nocturnal feeding from the beginning of L4, whereas in my series this occurred only in stage L5. L3 larvae in G.-B.'s series fed both in the daytime and at night, whereas in my series this was observed at stage L4.

G.-B. (1989 : 90) lists more than 10 species of grasses on which he found larvae of *statilinus* near

Madrid. 5 or more caterpillars were found on the following grasses : *Brachypodium phoenicoides*, *Stipa offeneri*, *Stipa parviflora*, *Stipa pennata*, *Poa* sp.

Hipparchia statilinus : 1 : Ovum. 2 : Distinctly pointed head of a newly hatched larva. 3 : L1 larva after beginning to feed. 4 : L1 larva before feeding. 5 : L2 larva. 6 : ♂ adult from Mount Faito (bred). 7 : L3 larva. 8 : L4 larva. 9 : Head of adult larva. 10 : Habitat of *H. statilinus* on Mount Faito above the village of Massaquano on August 28th 1995. In the foreground, *Eryngium amethystinum*, a late-flowering plant visited by *H. statilinus*. The most densely concentrated population of *H. statilinus* lives on the open, almost completely treeless parts of the mountain slope. 11 : in L5 the larvae develop reddish-brown lateral stripes. 12 : Adult caterpillar (L6). 13 : Pupa.

Material from Mte. Faito. Photographs by D. JUTZELER.



The data reported in the literature indicate that the foodplant of *statilinus* differs according to the locality. The caterpillars reared from Mount Faito preferred *Brachypodium distachyum* which occurs in this area.

Pupa : On August 4th, 1996, a number of pupae were found, back-down, 1-2 cm below the surface of the soil.

Description of the pupa : A detailed description of the pupa has been published and illustrated by GARCÍA-BARROS (1986). This stage lasts from 19 to 31 days (G.-B., 1989b).

Adult : Two ♂♂ emerged in the greenhouse on August 19th and 29th, and five ♀♀ between September 1st and 18th. The time of emergence of the ♀♀ was rather late, and emergence was prolonged, perhaps due to the cold and rainy weather in Effretikon in July and August 1996. The fully developed butterflies delayed emergence until the few sunny days that occurred in this period.

Data from the literature

Distribution : North Africa (Tunisia, Algeria, Morocco), Southern Europe, Western Europe (France, very locally in Holland), parts of Central Europe and Southern Russia (Crimea, Lower Volga), South-Eastern Europe, Anatolia, Transcaucasia. In Italy, the range reaches Sicily and includes the islands of Ischia (KUDRNA & LEIGHEB, 1988) and Elba (BIERMANN & HESCH, 1982b).

H. statilinus seems to be absent from the Aegean islands (OLIVIER, 1993), the Balearic islands (FERNÁNDEZ-RUBIO, 1991 : 163-165), Sardinia (BIERMANN & HESCH, 1982a), Corsica (RUNGS, 1988), Malta (VALLETTA, 1966) and Cyprus (MANIL, 1990).

Habitat and flight period : *H. statilinus* is present in xerothermic habitats : In the northern part of its range it occurs in warm, dry sand-heaths (REINHARDT & KAMES, 1982) and sand dunes (e.g. in Holland). In southern Europe the species has a widespread distribution on open, stony, waste areas. Flight period : after mid-July. Late individuals are still found in October.

Behaviour : Adults settle on the bare ground, on rocks or stones. The ♂♂ rest on the ground with their wings closed, awaiting passing ♀♀, and drive off other ♂♂ of their own species and butterflies of any other species, exhibiting a well-marked territorial behaviour. If scared, both ♂♂

and ♀♀ will settle again in a suitable place, 20-30 m off.

Variability : Adults show a high degree of individual and local variability, especially in the pattern (variable contrast) and colouring of the hindwing underside (from brown to dirty white). In the past this led to the description of numerous subspecies (see also the specimens of *statilinus* from Turkey figured in HESSELBARTH *et al.* (1995, vol. 3 : 210-213). Populations with a similar appearance are scattered over the entire range of the species, with a mosaic-like distribution, the predominant design of each population showing no apparent relationship to the geographical and climatic features of the locality. LORKOVIĆ (1974) pointed out, that the pattern and colour of the underside are influenced exclusively by the colour of the ground. As a species that settles on the ground, *statilinus* is subjected to the selective pressure of predation by voracious enemies. Individuals with a more effective cryptic adaptation are better able to avoid predation, thus leading in course of time to the stabilization of local phenotypes. However, individuals that diverge from the local pattern are also constantly found in every population. Clearly, therefore, these local ecological phenotypes do not deserve subspecific rank. Thus the variability observed throughout the whole range of *H. statilinus* can be interpreted as a variable expression of a uniform genetic pool. In his "Revision of the genus *Hipparchia*", KUDRNA (1977 : 118-119) concluded that more than 50 names for "forms" of *statilinus* should be sunk in synonymy, especially in the light of the work of LORKOVIĆ (1974).

H. statilinus can vary considerably in size : HESSELBARTH *et al.* (1995) mention a population from central Anatolia in which the forewing is 2-3 mm shorter than in populations from the Anatolian borderlands. The authors concluded that there is a correlation between the length of the forewings and the growth (= productive) phase of the foodgrass of these populations.

Presumably also, persistent dry weather can affect the size of *H. statilinus* and other *Satyrinae*. On the Sierra de Albarracín (Spain), on August 12th and 13th 1994, a year marked by an extremely dry summer in the Iberian peninsula, I noticed that all the *H. statilinus* were no larger than the *Pyronia tithonus*. Presumably, growth of the foodplants (grasses) had been so stunted during the period of greatest development of the *statilinus* larvae, that they had suffered from lack of food. The *Pseudotergumia fidia*, also observed in Albarracín at the same time, were also of exceptionally small size.

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