

**The moth that contravened the GAUSE's principle:
a solution to the "*Brithys encausta/pancratii*" dilemma**

(Lepidoptera, Noctuidae, Ipimorphinae)

by

ALBERTO ZILLI & FRANCESCO P. ROMANO

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Abstract: *Brithys encausta* (HÜBNER, [1803-1808]) is here considered an albinic form of *B. crini pancratii* (CYRILLO, 1787) owing to the following evidence: syntopic and synchronic occurrence in several localities without any ecological displacement, detection of a continuum of intermediate forms linking the extreme phenotypes, absence of diagnostic characters both in the genitalia and the larval pattern.

Noctua pancratii CYRILLO, 1787 = *Noctua encausta* HÜBNER, [1803-1808] syn. rev.

Introduction

One of the most controversial cases of taxonomic uncertainty in Noctuidae has long been presented by the status which should be conferred to the species-group taxa within the genus *Brithys* HÜBNER, [1821]. *Brithys pancratii* (CYRILLO, 1787), from Africa and south-west Mediterranean, has been variously graded with respect to the eastern-palearctic and indo-australian *B. crini* (FABRICIUS, 1775) (GREENWOOD, 1934; DUFAY, 1975; BRETHERTON & HAYES, 1976; BERIO, 1985), being currently considered a synonym of the latter (FIBIGER & HACKER, 1991). According to BERIO (1978), however, some differences would also be present within *pancratii* between mediterranean and east african specimens. Because of the marked allopatry between *pancratii* and *crini* the problem is of difficult solution and it will not be further analyzed here. Nevertheless, the occurrence of intermediate populations in Madagascar and Mauritius supports as most the ranking of *pancratii* as a subspecies of *crini*, not as a species on its own (BRETHERTON & HAYES, 1976).

From OCHSENHEIMER onwards (cf. TREITSCHKE, 1825:184), *Brithys encausta* (HÜBNER, [1803-1808]), endemic to the central Mediterranean, has similarly been questioned as to whether specifically distinct from *pancratii* in most of the classic works on Noctuidae (e.g. DUPONCHEL, [1837]; GUENÉE, 1852). However, species status is usually conferred to *encausta* (e.g. WARREN, 1910; BERIO, 1985; FIBIGER & HACKER, 1991) owing to a series of reasons which can be summarized as follows: 1) nearly parapatric range, 2) sharply contrasting habitus, 3) absence of intermediate forms, and 4) small but detectable differences in the male genitalia. These and other related points are discussed herein.

1) Range

It is at first desirable to critically evaluate some quotations of *encausta* at the northern limit of its range in order to assess its actual distribution.

All the quotations for Liguria (La Spezia) (e.g. CURÒ, 1877; CALBERLA, 1888; HAMPSON, 1905) date back to GHILIANI (1852:162). Nevertheless, such quotations are mostly incorrect

references to GHILIANI's work. In fact, while reporting *pancratii* from Sardinia and Liguria GHILIANI added "var. *encausta*" in his list in order to elucidate, further in the text, its conspecificity after rearing of sicilian larvae (GHILIANI, 1852:230). Therefore, any occurrence of *encausta* in Liguria is not confirmed.

CALBERLA (1888) quoted *encausta* for Latium (Anzio) because of a specimen found amongst *pancratii* larvae which was coloured in a different manner. Also this record is unreliable since that larva died before attaining the adult stage (CALBERLA, 1888) and the larval colour is devoid of diagnostic value (see further).

A few specimens from Lido di Lavinio (southern Latium) bred by BERTONCINI were paler than normal *pancratii*, although definitely not as white as *encausta* (PROLA, pers. comm.).

According to PROVERA (1978), BARBERA bred three specimens of *encausta* from larvae collected in the Abruzzi (Pescara). These specimens, which have been examined for the present work (Abruzzo, Pescara pineta, 18.V.1950, 30.VI.1951, 25.VII.1952, BARBERA leg., in Museo Civico di Storia Naturale di Genova), show an intermediate colour between *encausta* and *pancratii*.

Although the coasts of Apulia (south-eastern Italy) are one of the areas where as a rule only *encausta* can be encountered (PARENZAN, 1979), there is a reliable record of *pancratii* (FIORI det.) from southern Apulia (FAGGIOLI, 1933).

As evidenced by HACKER (1989), all the quotations for Greece and the Ionian Islands must be referred to STAUDINGER's (1871) for Corfu. However, HAMPSON (1905) lists one female from Greece.

The record of *pancratii* for Albania by HEINICKE (1965) might be referred to *encausta* (HACKER, 1989).

Besides showing that *encausta* and *pancratii* are sympatric over large extensions, a careful analysis of the most detailed literature with accurate faunistic data also indicates that they are often syntopic: Tunisia (ROTHSCHILD, 1920), Cyrenaica (TURATI & ZANON, 1922), Sicily (GHILIANI, 1851, 1852; RAGUSA, 1885, 1923; MINÁ PALUMBO & FAILLA TEDALDI, 1888).

In order to establish with certainty whether or not they occur together, adults and several larvae of equal age have been sampled from various localities along the southern and eastern coasts of Sicily. There are no recent records of *Brithys* from the northern Sicilian coast because of the environmental upsets deriving from human activities. In all the localities so far surveyed both *encausta* and *pancratii* have been observed, although with different proportions according to the localities (GRILLO, pers. comm.; PROLA, pers. comm.; ROMANO & ZILLI, unpublished). According to MINÁ PALUMBO & FAILLA TEDALDI (1888) *encausta* and *pancratii* used to coexist also in the northern coast of Sicily in the same localities.

As far as the authors know, the only areas where only *encausta* has been recorded within its own range are Corfu, great part of the Apulian coast south of Gargano, Lucania (Ionian coast), and Malta (STAUDINGER, 1871; PARENZAN, 1979; SAMMUT, 1984; BERIO, 1985).

According to PARENZAN (1979), in other islands near Malta, such as Pantellaria and Lampedusa, *pancratii* is so far recorded.

2) and 3) Habitus and intermediate forms

The colour differences between typical *encausta* (forewing ash white) and *pancratii* (dark brown or black) are striking. Nevertheless, intermediate phenotypes have been discovered in biotopes where both occur (fig. 1). Also the colour of "true" *pancratii* and *encausta* shows intra- and interpopulational variability, *encausta* being sometimes greyish and *pan-*

cratii paler. Some Sicilian *pancratii* show a little whitish suffusion in the lower half of the median field, whereas the darkest specimens in Italy come from the northern Tyrrhenian coast. As evidenced above, intermediate specimens were also collected at the northern limit of the *encausta* range (Abruzzi, Pescara).

Therefore, the most severe restraint to GHILIANI's (1851) synonymizing of *encausta* with *pancratii*, namely the absence of intermediate forms (LEDERER, 1857), is no more valid.

4) Genitalia

The differences in the male genitalia which were pointed out by BERIO (1985) appear as no more than individual traits, likely enhanced by the comparison of distant populations. In fact, neither in the male nor in the female genitalia constant differences have been detected. A certain degree of variability affects the shape of some male genitalic structures. Both the uncus, mainly the width of the notch on its ventral helmet-like process, and the saccular process of the right valva are known to vary at a certain extent (figs. 2-4), but such variability is independent with respect to the habitus. The study of the everted vesicae has not revealed any character of diagnostic value (fig. 5).

Caterpillars

No significant difference has been detected in all the caterpillars which have been examined over the years in Sicily. Data from literature suggest that a certain variability affecting the size of white spots may occur but it shows no congruence with the adults. RAGUSA (1885) referred to have obtained *encausta* from larvae darker than that of *pancratii*, but WARREN's (1910) and TURATI & ZANON's (1922) observations were opposite.

Ecology

According to data from literature and observations from the wild, neither in adults nor in larvae phenological, noctidiurnal or other ecological displacement has ever been noticed.

Whether it may happen that two species share the same ecological niche in allopatric areas, if they occur together one usually replaces the other, unless some ecological displacement takes place between them allowing their coexistence. This phenomenon, which is variously known as the competitive exclusion or GAUSE's principle (HARDIN, 1960), is even more effective depending on the degree of niche overlap and with narrow niche widths, i.e. when the spectrum of the exploited resources, such as food, space, time, is limited.

The field observations in biotopes where both *encausta* and *pancratii* live have long revealed a complete overlap of their niche exploitation pattern (e.g. indistinguishable caterpillars feeding simultaneously on the same leaf). The unusual bionomics of *pancratii* along mediterranean coasts (MILLIERE, 1864; HERING, 1930; HENRIOT, 1933; EITSCHBERGER & STEINIGER, 1976; CARPANETO et al., 1983; BAIXERAS et al., 1985) correspond exactly with that of *encausta*. In Sicily both are at least double-brooded with eclosions going on for 3-4 months, although in certain localities an increase in the *encausta* vs. *pancratii* frequency has been observed at the end of the season.

Conclusions

In Sicily the puzzle of the two species contravening the competitive exclusion principle has always been solved by local naturalists by considering *encausta* and *pancratii* as colour

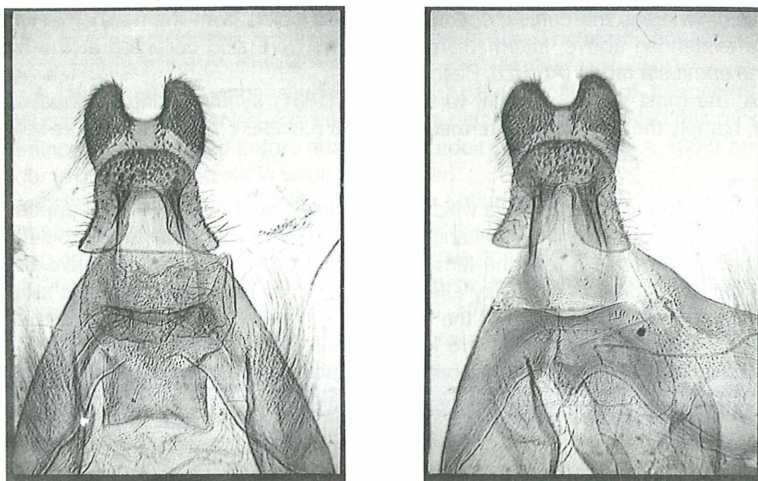


Fig. 2: variability of the uncus in *B. crini pancratii* CYR. from Sicily, prov. Agrigento, Licata, Torre di Gaffe (left "*encausta*"; right "*pancratii*").

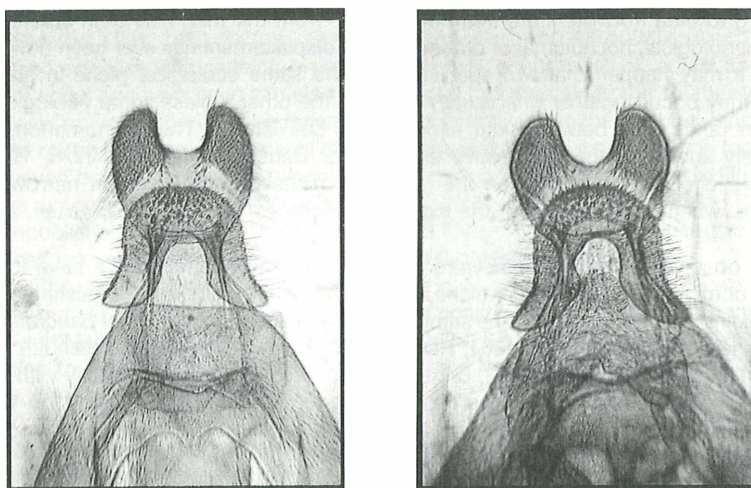


Fig. 3: variability of the uncus in *B. crini pancratii* CYR. from Sicily, Torre di Gaffe: detail of the uncus (left "*encausta*", same specimen of fig. 2; right "*pancratii*").

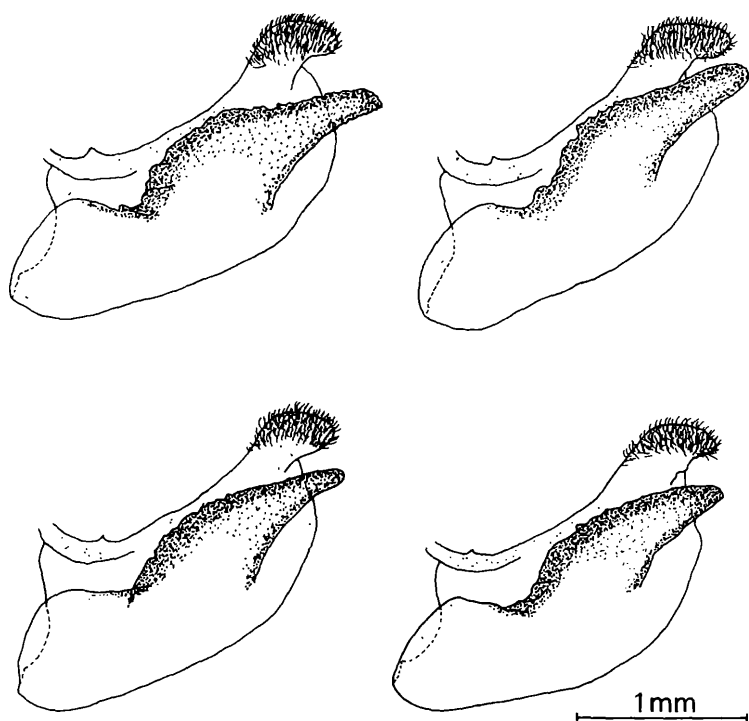


Fig. 4: variability of the sacculus process of the right valva in *B. crini pancratii* CYR. from Sicily, Torre Vendicari (top "encausta"; bottom "pancratii").

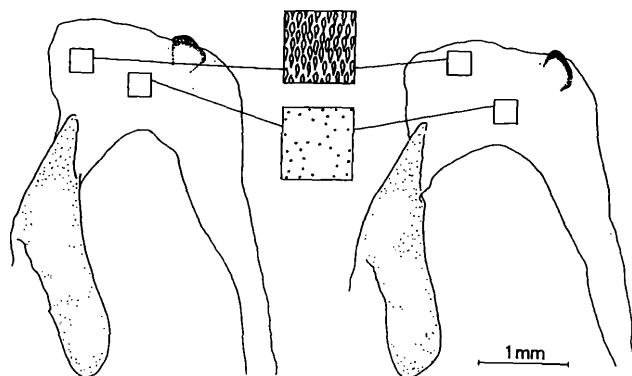


Fig. 5: everted vesicae of *encausta* (left) and *pancratii* (right) phenotypes of *B. crini pancratii* CYR. (Sicily, Torre Vendicari).

forms of the same species. Because of the discovery of intermediate forms we suggest to agree with this parsimonious opinion, accordingly:

Noctua pancratii CYRILLO, 1787 = *Noctua encausta* HÜBNER, [1803-1808] syn. rev.

Paradoxically, standing *encausta* as an albinic form of *pancratii* opens up new prospects for further research. The presence of a wide spectrum of intermediate forms show that quantitative inheritance is involved. Nevertheless, as the intermediate phenotypes appear to be scarcer than the extreme ones, it should be investigated whether this is due to assortative mating, epistatic or other effects such as habitat correlation (WEINS, 1976).

Populationally speaking, the origin and spreading of albinic phenotypes in a restricted area of the *pancratii* (viz. *crini*) range, as well as a possible selective advantage for one of the two forms according to the localities, require further studies. A profitable comparison with other sand-inhabiting species showing colour polymorphism/polyphenism (e.g. *Agrotis ripae* (HÜBNER, [1823]) and its f. *weissenbornii* FREYER, 1845) might be attempted in order to clarify the phenomenon.

It should not be underestimated, however, that a possible environmental induction may be involved. This is suggested by the increase in frequency of the form *encausta* in late summer which might reflect a subtle interaction between genes and abiotic factors during the postembryonic development.

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Colour plate XI (p. 311)

Fig. 1: *Brithys crini pancratii* CYRILLO: transitional series from *encausta* Hb. (top left) to *pancratii* CYR. (down right) phenotypes in a sicilian population. All the specimens were collected from the wild at the same spot in the same night (Sicily, prov. Siracusa, Torre Vendicari, a.s.l., 25.III.1989, A. ZILLI leg.).

Authors'addresses:

Dr. ALBERTO ZILLI
c/o Department of Animal
and Human Biology
Viale dell'Università 32
I-00185 Rome
Italy

Dr. FRANCESCO P. ROMANO
Piazza Cataldo 10
I-90040 Capaci (PA)
Italy

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