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Leptidea reali REISSINGER 1989 (=*lorkovicii* REAL 1988), a new European species (*Lepid., Pieridae*)

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Lorković, Z.: *Leptidea reali* REISSINGER 1989 (=*lorkovicii* REAL 1988), a new European species (*Lepid., Pieridae*). **Natura Croatica, Vol. 2, No 1, 1993, Zagreb.**

After a thorough analysis of the original description of *Leptidea reali* REISSINGER 1989 (=*lorkovicii* REAL 1988) as a new species from the eastern Pyrenees, described by J. Réal five years ago, it is now characterised in more detail. The new species is distinctly different from *L. sinapis*, and may be accurately identified by greatly prolonged genitalia alone. It is found not only in the Pyrenees but also in Croatia and some adjoining countries, as well as in Sweden, Poland, and Ukraina, where it occurs simpatrically with *sinapis*, predominantly in lowlands, with *Lathyrus pratensis* as the main host plant. Premating sexual isolation has been experimentally confirmed.

Key words: *Leptidea reali, sinapis, lactea, melanogyna,* specific characteristics, genitalia, variability, host plants, habitat, distribution, sexual isolation, courtship, semiartificial copulation, Croatia, Slovenia, Spain, Pyrenees, Sweden, Poland, Ukraine.

Lorković, Z.: *Leptidea reali* REISSINGER 1989 (= *lorkovicii* REAL 1988) nova vrsta *Rhopalocera* u Europi (*Lepidoptera, Pieridae*). **Natura Croatica, Vol. 2, No 1, 1993, Zagreb.**

Originalan opis nove vrste *Leptidea reali* REISSINGER 1989 (= *lorkovicii* REAL 1988), koju je prije pet godina opisao prof. Réal (Aix-en-Provence) iz 1300 m visine istočnih Pireneja, nadopunjuje se potrebnim novim podacima. Nova vrsta razlikuje se posve sigurno od *L. sinapis* L. 1758 jedino po jako produljenim primarnim genitalnim organima. Ne nalazi se samo u Pirenejima, nego je obična u Hrvatskoj i susjednim zemljama, te u Švedskoj, Poljskoj i Ukrajini, gdje je simpatrička i sintopička s *L. sinapis*, pretežno u ravnici s *Lathyrus pratensis* kao glavnom ovipozicijskom biljkom. Eksperimentalno je dokazana prekopulatorna seksualna izoliranost od *L. sinapis*. Populacija iz Hrvatske opisuje se kao ssp. *melanogyna* nov.

Ključne riječi: *Leptidea reali, sinapis, lactea, melanogyna* ssp., nov., varijabilnost, genitalije, hranidbene biljke, stanište, Hrvatska, Slovenija, Pireneji, Korzika, Španjolska, Švedska, Poljska, Ukrajina.

INTRODUCTION

Five years ago the spring generation of the monovoltine population of *Leptidea sinapis* L. from the easteren Pyrenees, at an elevation of 1300 m NN, was described by Professor P. G. J. Réal (1988) as a separate species *L. lorkovicii.* Already in the following year this new species, being a praeoccupied homonym of *L. duponcheli lorkovici* PFEIFFER 1932, had to be officially renamed into *L. reali* by E. REISSINGER (1989). Description of the new species appeared in the little known and non-periodic publication "Mémoires du Comité

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de Liaison pour les Recherches Ecofaunistic dans le Jura" Besançon. Since this new species was not mentioned in the title of this paper, it did not attract the attention of those interested, and thus passed almost unnoticed. Description was accompanied merely by linedrawings of the adult male and female butterflies and their genitalia.

The new species would not have been recognized as such were it not for the ductus bursae of the female, which is about one third longer in *L. reali* than in the common *L. sinapis,* so that the width of variation of this marking in the two species are separated by a gap nearly as large as the width of variation of *L. sinapis* itself. Each female specimen may thus be reliably identified by this marking. By contrast, no adequate attention was given to the male genitals because of the obviously different illustration scales (none were given), the size of the organs could not be properly compared, and, in addition, the description was incomplete.

During three years following original description of the new species, no additions or completions were published, especially no photographs of adults were given. For that reason E. von Mentzer was proposed to visit the eastern Pyrenees in order to find at least few specimens of the new *Leptidea* species, so that necessary additional studies would become possible, permitting a better idea of the new species. With the help of 12 males and 4 females of the new species obtained from the locus classicus La Montailla (1300 m NN) and from a newly discovered locality Mont Louis (1500 m NN), the way for a more complete knowledge of the new species was open.

The most important finding was that the male genital organs, aedoeagus and saccus, are much longer than in *sinapis,* which indeed, in connection with the length of ductus bursae of the female, could be expected.

However, after the inspection of the collections, private and museal, that of Eitschberger's included, and the dissection of both female and male genitalia, it become obvious that the new species was not limited to the eastern Pyrenees but appears in other parts of Europe too, especially frequently in Sweden, Croatia, Slovenia, southern Poland and Ukraine; that it is not exclusively a mountain species but inhabits lowlands and even large plains too. Therefore it is two- or three-voltin with marked seasonal phenism, being more characteristic for *reali* in the summer generation than in the spring one. Moreover, since 1925 the species has been successfully bred several times by the author in the form ♀- *andromorphica* VERITY 1911, what was of a great facilitation in difficult distinction of the two species, without genitalisation.

What we know now will allow us to learn more about the distribution of the new species in Europe and to distinguish its characteristics from those of the *sinapis.*

MATERIAL AND METHODS

For the taxonomic analysis of the characteristics of *L. reali* the genitalia of 45 ♂♂ and 34 ♀♀ *reali* and 45 ♂♂ and 20 ♀♀ *sinapis* were investigated, mostly from Croatia;

only a few were from the Pyrenees, Spain, Sweden and other countries. The relatively small number of analysed *sinapis* ♀♀ is understandable in view of the fact it was the reliability of determination of the ♀- *andromorphica* form as the variably expressed female sign of the *reali* that primarily had to be tested. Slides of genitalia of 10 ♂♂ and 15 ♀♀ of *sinapis* were made by Eitschberger, 2 ♂♂ and 3 ♀♀ of *reali* by von Mentzer.

Projected on a drawing board, a microscopic picture of the ductus bursae, of the aedoeagus and saccus, was measured, enlarged by Obj. 2, Eyepiece IV for ductus bursae and Eyepiece I for the male organs, respectively. This corresponds to an enlargement of 80x for the ductus and of 40x for the male organs. For each enlargement an appropriate scale was drawn.

Because of the large number of variants of the genital organs and the relatively small number of investigated individuals, whole range of variants were not worked out. Calculation of the standard values and the average errors were therefore omitted.

Generally, the ductus bursae in *Leptidea* and Dismorphiinae is strongly chitinised (sclerotized) from the ostium bursae to the branching-off of the ductus seminalis and thus can be well distinguished from the other part of the bursa copulatrix. This sclercotized part was therefore measured in hundredths of a millimeter.

There is no coecum penis in the aedoeagus, so its limitation towards the ductus ejaculatorius is sometimes rather arbitrary. With the saccus, the length from its end to the middle of the bending with the vinculum was measured.

Research of adult forms of the *Leptidea* specimens is an unhandy and time consuming job, it is necessary to examine both sides of wings, although in most collections only the upper side is visible. But for the *sinapis* and *reali* determination, only the upper side of the fore wings and under side of the hind wings (because there is no pattern on the upper side), are important. To solve this problem, the best method is to prick a fresh or moist specimen, with folded wings (as usually stored in envelopes) through its side. Then mount the specimen on a spreading board and fasten it there with strips of paper - in a way to be able to pull the inferior fore wing, by using an insect pin, far enough forward so that both, under surface of the one hind wing and almost the entire upper surface of the one fore wing, are visible simultaneously.

RESULTS AND DISCUSSION

1. Analysis of adult characteristics

A. The genitalia

a. The female (Fig. 1-4).

From Table 1 and Diagram 1 of the length variability of ductus bursae in *L. sinapis* and *L. reali* (data from Croatia) it can be seen that the variation widths of both taxa are so widely separated from each other that the interruption extends for almost one complete variation width of the *sinapis* itself. This fact is a convincing proof of the total reproductive isolation of both taxa. In addition to the length of ductus bursae, its stronger chitinization is also characteristic for *sinapis*, as well as its dark-brown colouring, by contrast to the almost colourless, bright-gray ductus of *reali*, and with its finer ventral point of the ostium (Fig. 1-4).

Table 1. Maximal and mean length values of ductus bursae of *Leptidea sinapis* and *L. reali* in Croatia, Spain, and Pyrenees.

Leptidea sinapis			*Leptidea reali*		
Location	N	Length in mm	Location	N	Length in mm
Croatia	17	0.48 - **0.56** - 0.64	Croatia	24	0.77 - **0.91** - 1.01
Spain	3	0.63 - **0.64** - 0.65	Pyrenees	7	0.80 - **0.91** - 0.96

Table 2. The maximal and mean length values of the male genital organs; aedoeagus and saccus of *Leptidea sinapis* and *L. reali* from Croatia, Spain, viz. Pyrenees orientales (France, Spain).

	Leptidea sinapis			*Leptidea reali*		
Organ	Loc.	N	Length in mm	Loc.	N	Length in mm
Aedoeagus	Cro	35	1.33 - **1.50** - 1.60	Cro	40	1.64 - **1.82** - 2.02
	Spa	10	0.37 - **1.56** - 1.70	Pyr	5	1.82 - **1.96** - 2.10
Saccus	Cro	35	0.50 - **0.60** - 0.72	Cro	40	0.65 - **0.81** - 1.05
	Spa	10	0.58 - **0.65** - 0.77	Pyr	5	0.73 - **0.94** - 1.00

For one *reali* female-specimen from Gerona and for four others from the eastern Pyrenees (three of them examined by E. v. Mentzer) a mean value of 0.928 mm was determined, just a bit higher than for the Croatian samples, while only two *sinapis* - ♀♀ showed 0.63 and 0.65; half of them already outside the plus-variant of the ductus of Croatian *sinapis*.

b. The male (Fig. 5, 6)

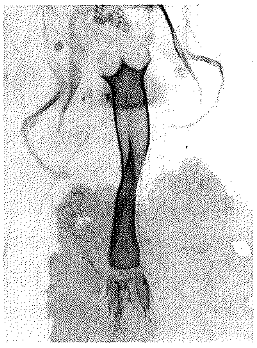
The discontinuity of the variation widths of *L. reali* and *L. sinapis* in the female sex is found also for the male genitalia, but it is less expressed. From Table 2 and the two diagrams in Diagram 2, an interruption can be seen in the variability of the length of the aedoeagus as well as saccus. The gap is more conspicuously expressed in positive correlation between the length of aedoeagus and saccus of both species (Diagram 2), especially in the sympatric populations. So, with respect to the genitalia, the Croatian specimens fall into two groups which have to be taken as reproductively separated taxa. Yet, if the Spanish *sinapis* are included, the discontinuity disappears. This, however, has no influence on the reproductive relations in Croatia. The same is true for the relations in Spain, where, according to higher values for the genital organs of *sinapis,* the genitals of *reali* are also relatively longer, so that there too, the discontinuity remains valid.

Why the size of two genital organs of both species become larger from East to West remains unexplained, for the time being. The increase cannot be attributed to the larger size of the butterflies because the Spanish *sinapis* seems to be the smallest European *sinapis,* while the East Pyrenean does not differ in size from other European populations.

The reason that the length of the saccus is in positive correlation with the aedoeagus lies in the fact that the ending of the saccus is the place attachment of the musculus retractor aedoeagi. At the beginning of copulation, the aedoeagus must first be drawn proximally in order to find its way (embraced by both halves of the paired uncus), to the ostium bursae, and penetrate into the ductus bursae (see Fig. 59).

In Diagram 2, the measures of the genital organs were not calculated by using equal dimensions of the wings, because the size of the butterflies (adults) has almost no influence on size of the genital organs; adults of the same size have aedoeagus and saccus of very different lengths, with average values scarcely differing from each other - a fact already known in lepidopterology. Only two very small specimens, having forewing lengths of 16 and 17 mm, have considerably shorter aedoeagus but their saccus values scarcely differ from the mean value of 0.77 mm. Therefore, in this work, relative length of the genitalia was not considered.

Therefore, the exceptionally large distance between the genital variability of the two species, remains the only possibility for an identification when wing characteristics are insufficient. An identification without an examination of the genitalia, in the case of these two species, remains a more or less daring assumption. Such a determination, up to now, has been possible only in the Pyrenees, where both species, for a period of time in July, are flying together, one that belongs to the spring generation, and the other to the summer brood. It is that phenomenon to which science is indebted for the discovery of a new species. To explain it after years of study, Prof. Réal proposed the notion of amphiphaenotism, the partially simultaneous occurrence of the first and second generation of a species on the same site on a mountain (RÉAL 1963).



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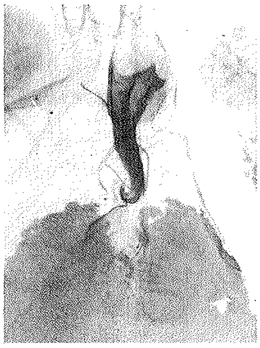

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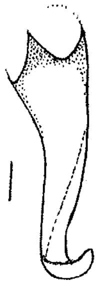

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Fig. 1-2. Ductus bursae of *Leptidea*, Microphotography, Obj. 2, Eyepiece IV, bar 0.5 mm. Ventral view with 8th sternit and part of 7+8th tergite dorsaly cut up lengthwise - 1, *L. reali* ♀, genit. prep. No. 1803, Zagreb, Zelengaj, 13. IV 1923. - 2, *L. sinapis* ♀, genit. prep. No. 1806, Zagreb, Stenjevac G. 20. IV 1952.

Fig. 3-4. Drawing of ductus bursae, bar 0.1 mm, - 3, *Leptidea reali*, ♀, genit. prep. No. 1814, Osredak, Croatia, 7. VI 1942. - 4, *L. sinapis* ♀, genit. No. 28/Mus Zagreb, Šestine, 7. VI 1981.

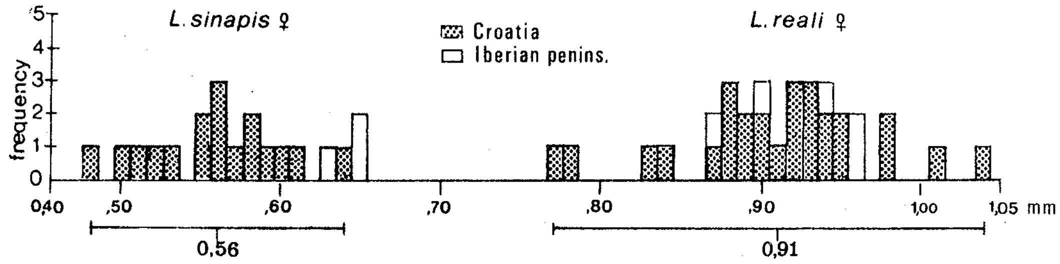


Diagram 1. Frequency distribution in the variability of the length of ductus bursae of *Leptidea sinapis* and *L. reali* for populations of Croatia (dotted columns) and Spain viz. Pyrenées orientales (open col.). The mean values apply for Croatia. Note the width of 0.12 mm discontinuity between both species.

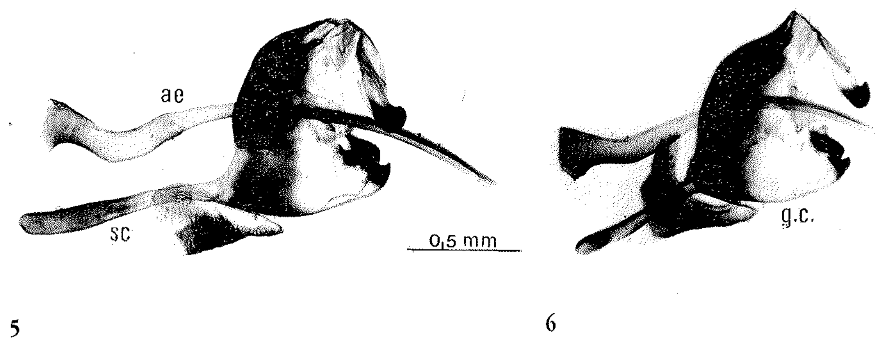


Fig. 5-6. Male genitalia of *Leptidea*. Microphotography, Obj. 2, Eyepiece I, bar 0.5 mm, *ae* aedoeagus, *sc* saccus, *g. c.* ventral edge of genital capsule, - 5, *L. reali*, genit. prep. No. 1821; Pustodol, Zagreb, 26. V 1986. - 6, *L. sinapis*, genit. prep. No. 1820, Pustodol, Medvednica mount., 9. IV 1992.

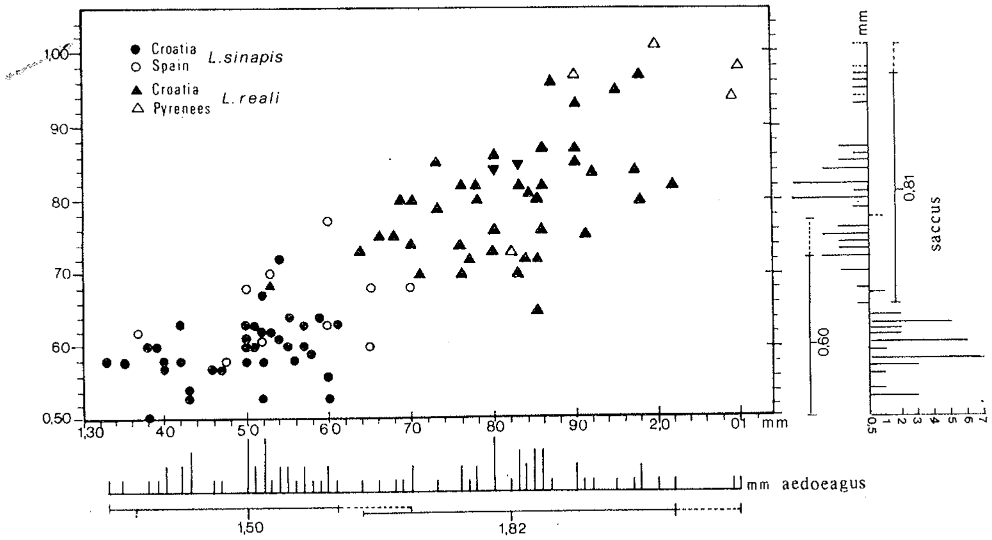
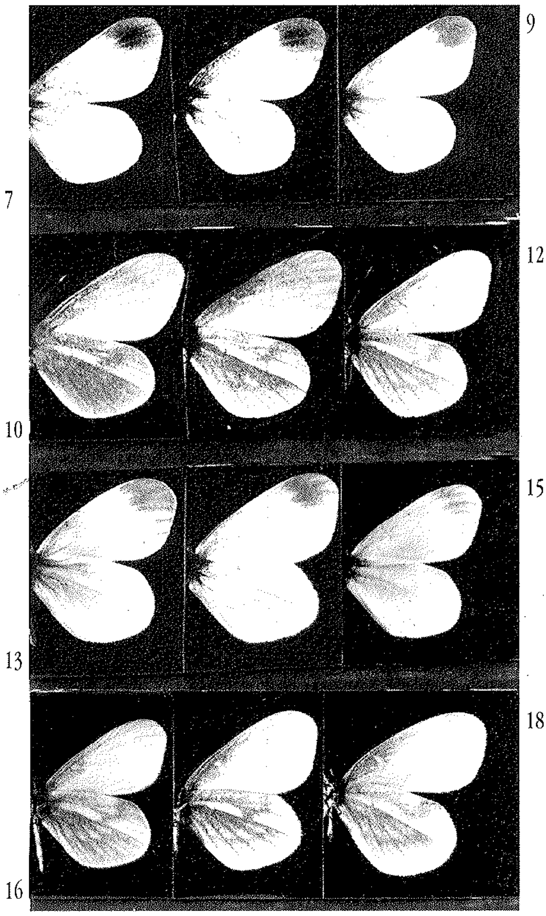
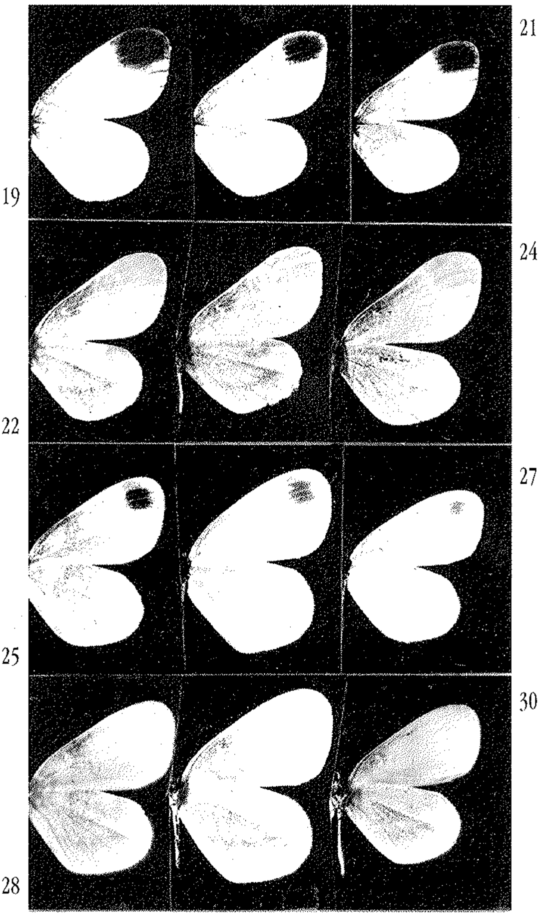


Diagram 2. Positive correlation between variability in the length (in 0.01 mm) of aedoeagus and saccus of *Leptidea sinapis* (closed circles) and *L. reali* (closed triangles) of Croatia viz. NE Spain (open circles) and Pyrenées orientales (open triangles). Below, and on the side of the table, the diagram for each genital character is given separately, with corresponding mean value for Croatia. Interrupted continuation line apply for Spain and Pyrenees.

Leptidea reali



1st generation
Fig. 7-9 ♂ upper side
Fig. 10-12 ♂ under side
Fig. 13-15 ♀ upper side
Fig. 16-18 ♀ under side

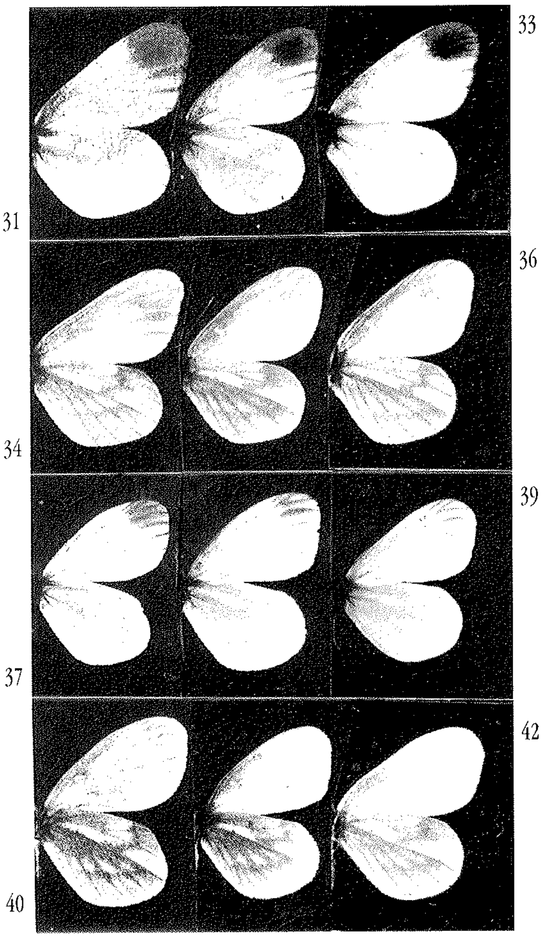


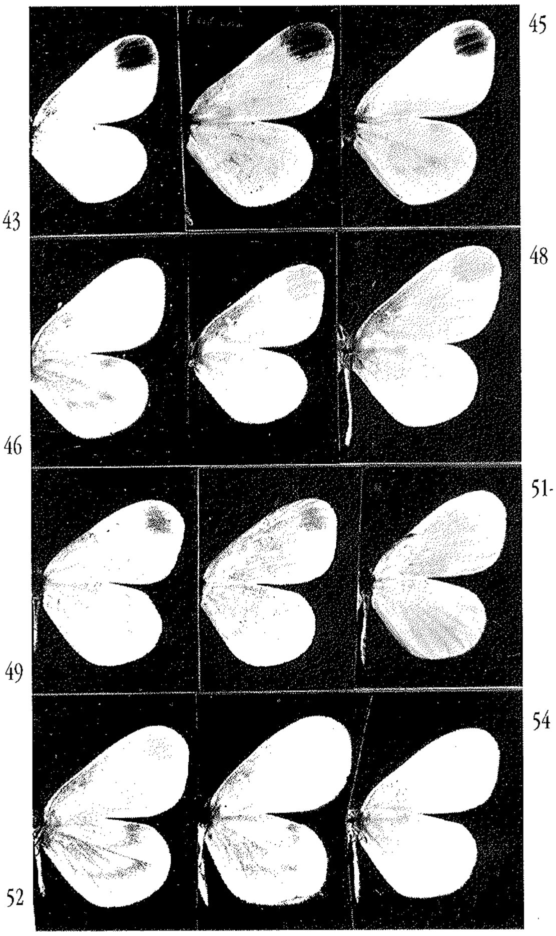
2nd / 3rd generation
Fig. 19-21 ♂ upper side
Fig. 22-24 ♂ under side
Fig. 25-27 ♀ upper side
Fig. 28-30 ♀ under side

The data of locations are presented in the Geographical distribution section, p. 16.

Photo: I. Lajtner

Leptidea sinapis





1st generation
Fig. 31-33 ♂ upper side
Fig. 34-36 ♂ under side
Fig. 37-39 ♀ upper side
Fig. 40-42 ♀ under side

2nd / 3rd generation
Fig. 43-45 ♂ upper side
Fig. 46-48 ♂ under side
Fig. 49-51 ♀ upper side
Fig. 52-54 ♀ under side

Fig. 31 *L. sinapis*, Gerona, Spain, 6.5.1969, Eitschberger.
Figs. 32-54, Croatia.

But how to explain that von Mentzer, in mid-July of 1991 on Mont Louis (1500 m), instead of finding fresh specimens of a second generation of *sinapis,* got only two heavily worn-out spring females, while on La Montailla (1300 m) he could find no *sinapis* at all? Can it be that von Mentzer did not reach the same site as Réal, or is it that the second generation of *L. sinapis* does not appear each year in equal numbers?

The differences, if any, in other genital organs or their parts, i.e. in corpus bursae, and the male "genital capsulae" were not found prominently enough to be included among useful devices for the taxonomic recognition of the two species.

B. Wing pattern (Figs. 7-54)

a. Wing shape

The straight or even slightly concave outer margin of the fore wing is a characteristic sign of *reali* which has already been stressed in the original description. The same is true on a reduced scale for the female sex in which the wings are more rounded than in the males. This mark is more prominent in Croatia than in the Pyrenees. However, a similar straight wing margin shows the spring form of *sinapis* too, especially in Northern Spain, in 32 percent of the cases, so that elongated and straighter fore wings are more frequent in *reali* than in *sinapis.*

b. Wing design upperside

In *Leptidea* the apical mark at the top of forewings and the pattern of the hind wings have to be taken into consideration. Generally, *reali* contains more black pigment than *sinapis.*

The apical mark. The sole specific distinctive characteristic mark of the wing design in a part of the female summer generation of both species can be:

a) black as in the males, only smaller and more roundish (f. ♀- *andromorphica* Verity 1911) (Figs. 25,26). . . *L. reali*

b) totally absent (in that case the underside is without any design too: f. ♀- *erysimi* BORKENHAUSEN 1788) (Figs. 51, 54). . . *L. sinapis*

The *reali* summer females are probably never without one, at least blackish-grayish apical mark (Fig. 27), while the *sinapis* summer females have not a black mark, but at the most a gray spot or light-gray shadow (Fig. 49, 50 overlapping with gray marked *reali* females) or nothing (Fig. 54).

♂. In conformance with the strong apical mark in the summer form of *reali* - ♀, it is usually also large in the male sex, it is deep-black and extends almost to the wing margin, without a noticeable brightening on the fore and side margins (Figs. 19, 21), a sign which is on the contrary characteristic of the midsummer *sinapis,* with *L. sinapis colladoi* RUBIO 1969 from Southern Spain as its European extreme (like Fig. 45). Namely, during high temperature the gray component of the apical mark along the veins disappears, so that only the black round kernel (the black intervein space) remains, separated by 1.0 to 1.5 mm from the wing margin, and moreover divided by one or two fine white vein lines (Fig. 45). Such a modification was not known, up to now, in *L. reali*.

One very rare, extremely black-spoted ♂ and ♀ pair, is present in the Cl. Dufay's collection (Chaponost, France), caught in Sesvete near Zagreb (Croatia), 17.06.1971.

Spring generation ♀. Although in the spring generation of *Leptidea* the apical mark in the female is composed of gray vein stripes, as it is almost the rule for *sinapis* (Fig. 38, 39), the stripes of *reali* are usually more or less fused by scattered dark scales (Fig. 15) and flow into one another (Fig. 14), forming in extreme cases a uniform gray spot, not smaller than in the males (Fig. 13). Nevertheless, both species cannot be surely distinguishable by this mark (Figs. 14, 49).

♂. In the spring generation, the apical mark of the *reali* males has an additional peculiarity: its costal prolongation in direction to the wing base (Fig. 7-9); this appears in less than 50 percent of the specimens. It can be seen also in *sinapis*, though vaguely expressed.

A more frequent markings in *L. reali* than in *L. sinapis* are the occurrence of black scales along the vein ends behind the apical mark, sometimes even up to the C_2, a feature valid not only for the males but, although a little more faintly, for the females too (Figs. 13, 14), and not less expressed in *sinapis* (Fig. 31), Gerona, Spain, 6.5.1979).

c. The underside design of the hind wings

The third characteristic of *L. reali* is the less clearly defined greenish gray of the under side of the hind wings in spring generation. The dark middle crossband often disappears almost totally, so that only the vein strips and the short, broken part of the crossband remain dark. In some specimens the underside of the hind wings is along the vein M_2 and throughout the middle of the discoidal cell divided in a bright fore and a dark hind half, which may remind us to *L. duponcheli*, especially in the earliest spring specimens, having a maximally uniform greenish gray underside colour, identical with f. *pseudoduponcheli* VERITY 1908/11 (Figs. 10). In *L. sinapis*, such specimens are rare because the crossband is more clearly accentuated (Figs. 34-36, 40, 41).

For the summer generation of *L. reali* it seems to be characteristic that they are never totally without a dark design on the underside (Fig. 24), as it is valid for the so called "*diniensis*" male and "*erysimi*" females of *L. sinapis* - provoked by the high temperature in southern regions and appearing, as a rule, in midsummer (Figs. 48, 54).

Conclusion. From the above, it follows that on the basis of the wing markings only the extreme variants of black apical mark of females of the second generation can be safely recognized as *reali*, while the other two markings can be used for identification only with a high probability. Any such identification must be confirmed by a dissection of the genitalia.

2. The preimaginal stages. It has already been mentioned that the larvae and pupae of the two species can only be insufficiently distinquished by eye, if at all, so that in the breeds 60 years ago, a difference was not noticed. Last year among the offspring (n=9) of three *reali* females from the surroundings of Zagreb, small differences could be found (Figs. 55-57). Their pupae are a little more yellowish-green and show a less distinct reddish lateral line on the abdomen and reddish lines along the pupal fore wings (Fig. 58). Since these marks were manifested with the offspring of the three females they can be taken as provisionally valid for *reali.*

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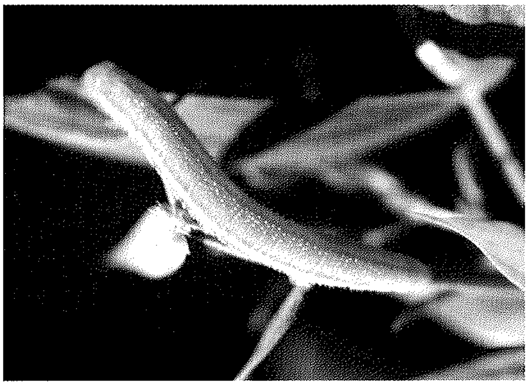

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Fig. 55-58. *Leptidea reali,* 55-57 reared mature larvae (4th instar), Slapnica, Žumberak Croatia, 22. VII 1992; bar = 1.0 mm. - Fig. 58, pupa from the same brood, 27 VII 1992, bar = 0.5 mm. Photo: B. Gjurašin

3. Oviposition and food plants. Two of the mentioned *reali*-females were brought in together with the plant *Lathyrus pratensis* on which the oviposition was observed. Eggs were laid singly. The oviposition took place only on that plant: *Lotus corniculatus* was totally and *Vicia cracca* hesitantly ignored. These observations were complemented during watching two *sinapis* females which persistently neglected young *Vicia cracca* in an open meadow, but instantly deposited an egg on a small *Lotus corniculatus,* when it was found after a rather long time of searching. However, the prompt oviposition of a captive female on *Lotus corniculatus, Vicia cracca* and *Coronilla varia (Lathyrus pratensis* was not at disposal) indicates that things are not so simple.

Three *reali* larvae were transferred, after hatching, on a *Lotus* plant where they soon found their resting place, began to feed, and reached the pupal stage without any detriment. This observation corresponds with the rule that the number of food plants of a butterfly is always higher than the number of oviposition plants (LORKOVIĆ, 1933).

An important confirmation that *Lathyrus pratensis* belongs to the regular host plant of *reali* comes from WIKLUND in Sweden (1977 b). On the island Ingerö, 30 km east of Stockholm, in 87.3 percent of the cases the egg were laid on *Lathyrus pratensis,* there the most common leguminose, and only in 10 percent of cases on *Lathyrus montanus* which grows in woods. On the other hand, on the *Lotus corniculatus* an egg was laid just once, but the plant is a rarity there. Significant is the annotation of WEIDEMANN (1968) who found larvae on the *Coronilla varia* and *Lathyrus pratensis* (with an illustration of the latter plant with eggs), but that the oviposition succeeded without difficulty on the *Lotus corniculatus* too.

The pupa of *L. reali* is very well adapted to the lanceted foliage of *Lathyrus,* because it is not easily detected on a plant. This is not the case with equally formed pupae of *L. sinapis* in relation to *Lotus* because this plant has more roundish leaves.

Whether or not ♀- *sinapis* is avoiding the *Lathyrus pratensis* must yet be investigated. It is questionable that among the many oviposition and food plants, cited in references, some "belong" to *sinapis* and other to *reali.*

4. The habitat of *L. reali* in Croatia. *L. reali* is most frequent in Podravina, along the Drava River plain - on moist meadows, where the Fabacea *Lathyrus pratensis* is found to be the ovipositing plant (KRANJČEV, pers. comm.). The *Maculinea telejus* is common in July and from mid July the *M. nausithous* as well; both are connected with their food plant the *Sanguisorba officinalis,* which grows on moist meadows at least in spring and semimoist to semidry later on in the year. *L. sinapis* is less frequent in this area; at the end of June of the year 1992 the ratio was 17 *reali* to 6 *sinapis,* given by random collection and genitally analysed specimens. Similar conditions are probably present in Žumberak piedmont region, where three above mentioned *reali*-females were found ovipositing on the *Lathyrus pratensis.* So far, the altitude reached by *reali* in Medvednica Mountain (1035 m), north of Zagreb, is not known. The capture of three *reali* specimens, even two females, without any *sinapis* around Osilnica near the Kupa River spring

(Hrvatsko in Croatia, Podvrh in Slovenia, L. Mladinov leg.) clearly demonstrate that in southeastern Europa *reali* inhabits mountainous regions, too. In Nat. Hist. Mus. collection in Zagreb there is a *reali* ♂, found at altitude of 1500 m on Maglić mountain (2386 m), on the boundary between Crna Gora (Montenegro) and Bosnia and Hercegovina ("16/7. '26., B. Gušić" leg.).

5. Sexual isolation. The facts communicated so far are in favour of species diversity, but only indirectly. Direct evidence will now be presented.

On August 6, 1992, in a valley of Medvednica Mountain near Zagreb, about 250 m NN, where *sinapis* was flying abundantly, a bred virgin *reali* female was put in a cage together with some captured *sinapis* - ♂♂. One of two older butterflies, at last, placed itself opposite to the quietly sitting female and its head and the outstretched proboscis began to oscillate. After three or four of such oscillations, the female executed a flicker with the wings, calming down the male for a few seconds. The courtship was continued after a short time, and was followed by one or two more wing flickers of the female. The pauses of the male became longer, until at last, after a few more wing swings of the female, the courting came to an end and the male withdrew. The whole procedure was the same as with a *sinapis* - ♂ and a conspecific already inseminated female (LORKOVIĆ, 1950).

After a while another male became active, but this time, after the second wing flicker, the female was taken with a pair of tweezers by the closed wings, so she could twitch the wings no more. At once the male descended to her side and tried to reach her abdomen point. He did not succeed because the female restless as she was, drew her abdomen high up between the wings; the efforts of the male ceased after half a minute. After a minute or so the whole procedure was repeated within a shorter time.

It was shown in previous experiments with copulated *sinapis* female that a second copula may be successful with a narcotized female. Such an experiment was not made here.

In that way the precopulative sexual isolation between *Leptidea sinapis* and *L. reali* could be confirmed directly. The reciprocal pairing trial was not made but a different result is not to be expected.

The next day, on the same place, a *reali* pair was found in copula. This was considered to be additional confirmation of the experimentally established reproductive isolation, because on the mentioned place for a *reali* - ♀ there were at least 16 times more *sinapis* - ♂♂ than *reali* - ♂♂, (16:1 was an approximative frequency relation of both species at the place of experiment).

The behaviour of the *reali* - ♀♀ vis-à-vis the *sinapis* - ♂♂ was thus the same as the *sinapis* -♀♀ behaviour towards nonconform ♂♂ - and as the behaviour of an already copulated *sinapis* female towards a conform male which, by temporary wing swinging, is prevented from further courting.

Strangely enough WIKLUND (1977 a) did not record the wing flickers of already mated *reali* female. It seems improbable that a *reali* female would react only towards nonconspecific males by wing swinging and not towards their own species, if she were already mated, as the *sinapis*-female do. Such a significant difference inside a species would, by itself, be more than a specific difference and might contribute to a generic difference, if not more. In all genera of Pierinae, the mated females reacted towards courting males by the same defense behaviour: the wings are spread flat and the abdomen is raised higher up (LORKOVIĆ, 1938 in MÜLLER-KAUTZ, p. 15). It is not clear why in the genus *Leptidea* should be a serious exception to this rule.

6. **The possibility of artificial copulation.** It seems impossible that between two species, with such an obvious difference in the lengths of genitalia, may come to copula.

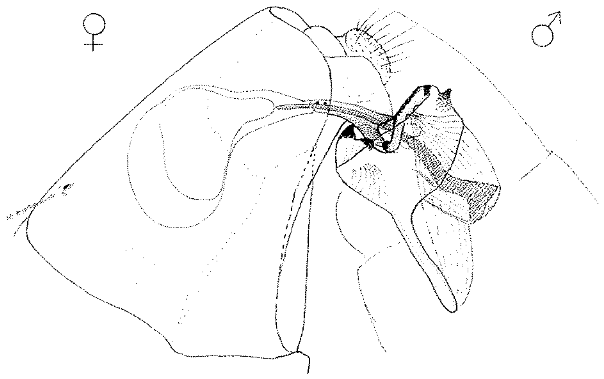

Fig. 59. Microscopic drawing of a fixated copula of *Leptidea sinapis* L. Approximately 20 minutes after the beginning, the end of abdomens were cut off and fixed in a mixture of ether and ethanol, than transferred through the ethanol succession in xylol (1944 unpubl.). The aedeagus penetrates into the corpus bursae as far as two fine thorns near the end permit.

Delinated by: Z. Lorković Photo: I. Lajtner

However, when Fig. 59, of a fixed *sinapis* copula is closely examined, then the possibility of semiartificial copula of *sinapis* - ♀ and *reali* - ♂ cannot be excluded. From the drawing it is apparent that the aedoeagus penetrates into the corpus bursae as far as two fine thorns, near the distal end of aedoeagus, make possible. The aedoeagus is fixed in this position by the musculus adductor aedoeagi between the base of aedoeagus and "vinculum" (tegumen). The long *reali's* aedoeagus might reach the end of short ductus bursae of *sinapis* in order to empty its spermatophore into the corpus bursae. There remains only the question: can the long aedoeagus of *reali* be fixed enough in spite of insufficient contraction of the adductor muscle of aedoeagus, due to the fact, that the basal half of the aedoeagus would stretch out of the genital capsel. Properly speaking it is a question of the physiology of this muscle.

STEKOLJNIKOV (1967), in his work on the functioning of the genital organ of Lepidoptera does not provide an illustration of the muscle of *Leptidea*, but the description of the genitalia of *L. sinapis* and the muscles involved completely correspond to our presentation of the functions in Fig. 59 during the copulation of this species, especially the observation that the length of the saccus corresponds to the length of the aedoeagus.

By such artificial copulation F_1-hybrids would develop, and the degree of their sterility may be analyzed by disturbance of their meiotic division, as the reflection of nonconjugation of changed "homologous" chromosomes. This, at the same time, would be a contribution to explanation of *reali's* phylogeny.

Geographical distribution. Because of an insufficient number of genital studies, it is still too early to talk about the distribution of a new species. Only established locations are cited here, from the West to the East, and from the South to the North: (Figs. 60).

1. **France:** Locus classicus La Montailla, Val de Nohedes, Pyrenées Orientales, and Marialles near Mt. Canigou, 1300 m, 25 ♂♂, 4 ♀♀, 19.7.1962 - 10.8.1963, P.G.J. Réal leg. et coll.

2. La Montailla, 1300 m, and Mt. Louis, 1500 m, 12 ♂♂, 3 ♀♀, 12.-17.7.1991, v. Mentzer leg. et coll. (4 ♂♂, 1 ♀ in coll. Lorković, Fig. 8, 11).

3. **Spain:** Ribas de Freser (Prov. Gerona), Pyrenees Or., 1000 - 1200 m, 1 ♂, 2 ♀♀, 16.-24.7.1967, Oorschot and Lourens leg. et coll. RMNH, NL-Leiden.

4. Caldos de Bohit (prov. Lerida), Pyrenees, 2000 m, 1 ♂, 22.7.1978, Oorschot and Lourens leg., coll., RMNH, NL-Leiden.

5. Gerona, 100 m, 1 ♂, 1 ♀, 25.5.1969, Eitschberger leg. et coll.

6. S'Agaro (Costa Brava), 1 ♀, 20.5-2.6.1978, Roessler leg., coll. Mus. Eitschberger.

7. Albaracin near Teruel, 1500 m, 1 ♂, 2.7.1960, F. Gross leg., Mus. Eitschberger.

8. Uña (Prov. Cuenca), 1200 m, 1 ♂, 12-17.6.1971, Caron leg. et coll. RMNH, NL-Leiden.

9. Cantabrian Mountains (Prov. Alava), Fig. ♀ genitalia, p. 111 (OLANO et al. 1990).

10. **France** Corsica, f. ♀ "andromorphica" VERITY (1911, 1945).

11. **Slovenia,** Ježica in the Sava-Valley near Ljubljana, 1 ♂, 15.5.1955, leg. et coll. Lorković.

12. Plešivec (Boč), 300 - 400 m, 1 ♂, 18.7.1954., leg. et coll. Lorković.

13. Podvrh, Osilnica, 450 m, 1 ♀ 13.6.1972., Mladinov leg., coll. Cro. Nat. Hist. Mus., Zagreb.

14. **Croatia,** 40 ♂♂, 23 ♀♀ (32 ♂♂, 13 ♀♀ *L. sinapis*) 1., 2., 3. gen.; 46 descendants of 3 *reali* "andromorphica" breedings; Zagreb, Turopolje, Podravina, Žumberak, Hrvatsko near the Kupa River spring etc.: 10.3-29.8.1925-1993 frequent: coll. Lorković, coll. Cro. Nat. Hist. Mus., Zagreb (Fig. 7-10, 13-16, 14-17, 15-18, 19-22, 25-28, 26-29, 27-30).

15. **Montenegro**, Trnovačko Lake, 1500 m NN, Maglić Mountain, 1 ♂ 15.7.1924., B. Gušić leg., coll. Cro. Nat. Hist. Mus., Zagreb.

16. **Austria**, Neubau-Kreuzstetten, 1 ♀ (?), 27.6.1941, Schwingenschuss, leg. et coll., Lorković. coll.

17. **Sweden**, Uppsala, Linnaeus Gjurgården, 6 ♂♂, 30.5.1957, leg. et coll. Z. Lorković (Fig. 9-12).

18. Veda, Upland, 1 ♀, 31.5.1959, leg. et coll. v. Mentzer.

19. Ingarö Island, SO Stockholm, WIKLUND 1977, Fig. 1-9.

20. **Poland**, SE, Ostrow, Ropczyce (East of Tarnov), 1 ♂, 2 ♀♀, 15.7.1930., St. Stach leg., coll. Lorković (Fig. 20-23).

21 **Ukraine**, Lvov, 6.6.1913., 1 ♂ (Fig. 21-24).

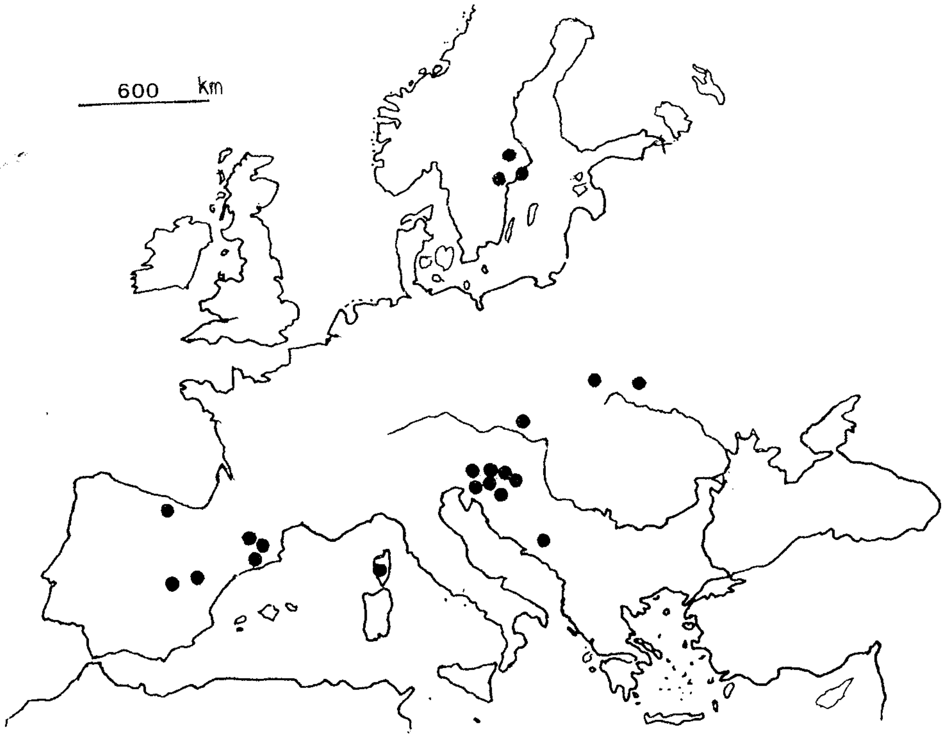

Fig. 60. Hitherto known locations of *Leptidea reali* (•) in Europe with test ran on genitalia. The locality Corsica is based on Fig. 27 of ab. ♀ - andromorphica Verity (1911, pl. XLVIII).

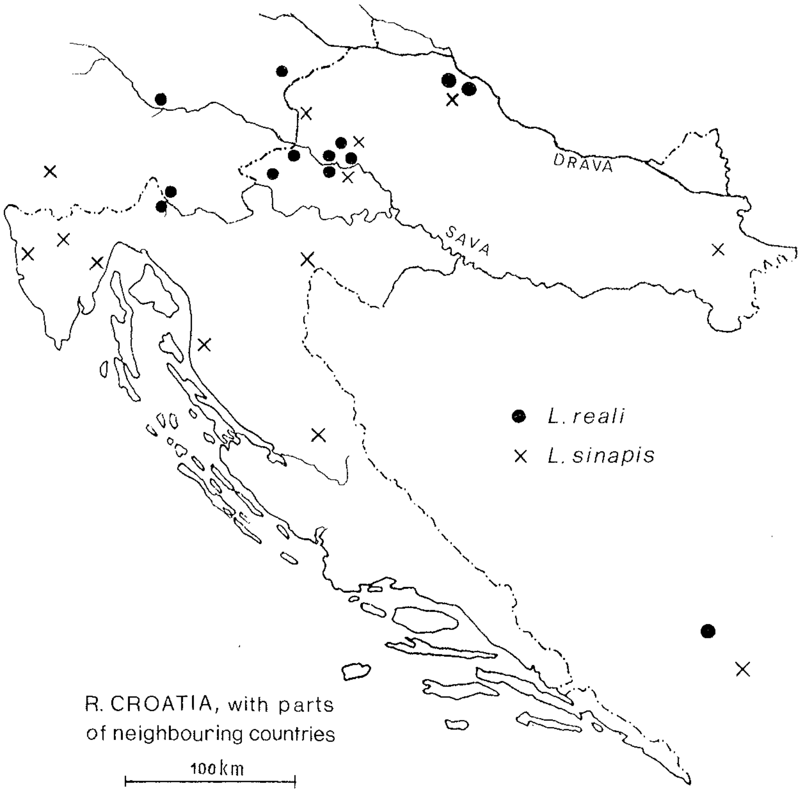

Fig. 61. Main locations known, so far, for *Leptidea reali* (•), and some of *L. sinapis* (x) in Croatia and two neighbouring countries with recent test ran on genitalia.

On the photographs of the diverse *Leptidea*, sent in 1931 by the firm Dr. O. Staudinger & A. Bang-Haas, Dresden-Blasewitz - on approval to the present author two spring females from Sardinia and one from Corsica show a very indistinct pattern on the hindwings underside, almost without any dark crossband, suggesting that they may be *reali*. This opinion is further strenghtened by the ab. ♀- "andromorphica" VERITY from Corsica (VERITY, 1911, table 68, Fig. 27, p. 343, ex coll. Leech) which is without doubt a *reali*. VERITY (1911, p. 343) described "race *corsica*" from Yerbury in Corsica: "... the design of the underside brownish, not green and very diffuse" stored in great series in Brit. Mus. If it were confirmed, by genitalia, that these specimens from Corsica belong to *reali*, than the name *corsica* would have priority and *reali* become a younger synonym. All this if the Verity's designation "race" would mean "subspecies" as REISSINGER (1989) attributes to the name *corsica* VERITY 1991.

Outside Europe, two males from Turkey, one of them by external features similar to *reali* (Palendöken Dag, 10-17.7.1978, Mus. Eitschberger) proved to be genitally *L. sinapis*. A specimen of *L. sinapis lathyrides* VERITY is this species by the genitalia, too. However, no female genitalia are known yet to the author, either from Turkey or from the Asia. According to this, *L. sinapis* is distributed throughout the palearctic region, from the Atlantic to Eastern Siberia. Is it the same valid for *reali* too?

8. On the evolution in Leptidea. The geographical expansion of a species is sometimes faster than its evolutionary change. In *Leptidea,* the greatest spatial extension was attained by *L. morsei* from the Pacific Ocean (northern Japan) throughout the Palaearctic region and almost to the Atlantic, during which time even its very unusual karyotype n=54 remains unchanged in Croatia (LORKOVIĆ, 1940) and Japan (MAEKI, 1958). On the contrary, *L. sinapis* from its western limit on the Atlantic does not reach the Pacific, but this species is much more variable than *morsei,* which the discovery of a sibling species *L. reali* does so unexpectedly confirm. It was before this finding that a quite similar hidden species was found in *L. morsei* too. When half a century ago the new species *Leptidea lactea* LORKOVIĆ 1950 was described, only the male genitalia were taken for comparision with *L. morsei,* on which occasion the considerably longer aedoeagus and saccus did not draw enough attention (Fig. 62 A,B.). It was only after the recent discovery of *L. reali,* that the female genitalia of *lactea* were examined too. It is not at all surprising that in *L. lactea* too the ductus bursae is almost twice as long as in *L. morsei,* (corresponding to the longer saccus and aedoeagus) and that the ductus bursae is also slender and colourless as in *reali* (Fig. 62, C, D). Moreover, as to the wing characteristics, *L. lactea* differs from *L. morsei* much more than does *L. reali* from *L. sinapis.*

Two species with almost the whole Palaearctic distribution are equipped with short genital ducts, while two of their sibling species with elongated ducts, *reali* and *lactea,* are much more restricted; the one to the western part of Palaearctic the other to its eastern part showing an interesting spatial symmetry of an identical genetic event on the two opposit points of a range. The ductus bursae of the rare *L. gigantea* LEECH 1890 female is still unknown, but judging from its 1.93 mm long aedoeagus and forewings length of 25.5 mm, one my expect that the bursa duct also corresponds to the lenght in *L. sinapis.*

The mentioned six Palaearctic *Leptidea* species are in the closest monophyletic relationships, originating from a precursor close to *L. gigantea* with similar clear basic wing design, from which the less clear design of each other *Leptidea* species can be derived (LORKOVIĆ 1950), (Fig. 63), forming a continued series ending with a suffused, completely uniform wing design of *L. duponcheli* or *L. reali pseudoduponcheli* VERITY, in which the basic design is no more recognizable (Fig. 10). Such a precursor of *Leptidea* could penetrate only from the New World, because the subfamily Dismorphiinae to which *Leptidea* belongs - is resident only in Neotropics, represented by the rich genus *Dismorphia*; in North America (Nearctic) neither a *Leptidea* nor a *Dismorphia* occurs.

This large empty interruption between Palaearctic and Neotropics makes the unespected divergence of both groups better understandable. In spite of the undeniable accordance of *Leptidea* and *Dismorphia* in respect to the peculiar genital armature, some other body parts and features are quite different; first the uncommonly short discal cell of the both wings and then the absence of an androconial sex-brand on the hindwing compensated in *Leptidea* by an entirely different courtship behaviour: the stimulation of the female by the oscillation of the outstreached male proboscis, a feature which indicates a separate advanced evolutionary level. To all mentioned peculiarities of the genus *Leptidea* the striking prolongation of the sclerotized male and female genital tube must be added for about a half of the species of this genus, an event unknown as yet in other Dismorphiinae.

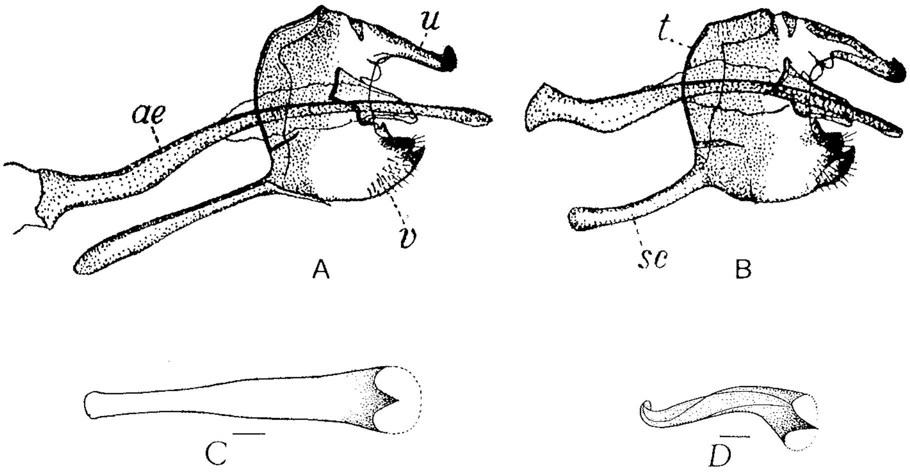

Fig. 62 A-D. Genitalia of (A) ♂ *Leptidea lactea* LORKOVIĆ 1950, No. 0347, and (B) *L. morsei tsinlingi* O. B. HASS, 1927, ♂ No. 0348, both from Tapaishan in Tsinling, China, 1700 m NN, 4.-8. VIII 1936, H. Höhne leg. (f. Lorković, 1950). - Female ductus bursae of (C) *L. lactea*, ♀ No. 1830, and (D) *L. morsei tsinlingi* ♀ No. 0097 the same localities and dates as for the males; bar = 0.10 mm.

If in all members of this subfamily the ductus bursae is so short as in *Dismorphia critomedia* HUEBNER (Lorković unpubl.) then the short ductus would be a primarily, plesiomorphic character for this subfamily, while the prolonged form would represent a younger, newly acquired apomorphic character.

According to this characteristic, and to the shortness of the discal cell, the Palaearctic group of the subfamily Dismorphiinae attained a further stage of differentiation of evolution than the neotropical group, although represented by a much smaller number of species.

9. The question of nomenclature. The question: to which of the two *Leptidea* species Linné's type *Papilio sinapis* belongs, should be settled as soon as possible, because after VERITY (1940), this specimen comes from Sweden. It is possible that it is a specimen of the *reali,* because this species is more widely spread and more frequent in Sweden than initially supposed. If, accordingly, the name *sinapis* is given to the new species, *reali* must become a synonym, while the hitherto existing species, having the short ductus and aedoeagus+saccus, must be renamed.

The present author is in no position to decide which of the three old names quoted by VERITY (1947) as synonyms for *L. sinapis* - *candidus* RETZIUS 1783, *loti* RENNIE 1823, and *candida* WESTWOOD & HUMPHREY 1841 - could be taken into consideration as species or subspecies names. The relevant old literature is barely accessible and the genitalization of attainable specimens is not feasible. Similar considerations also apply to a number of names from the list of BRIDGES (1988), most of which belong to subspecies, and only for ssp. *colladoi* RUBIO 1969 it is certain that they belong to the species with short genitals. This is very likely true also for *mendesi* BRYK 1940 and *pseudodiniensis* PFEIFFER 1927 from Anatolia, while ssp. *pumilia* DANNEHL 1933 remains suspect.

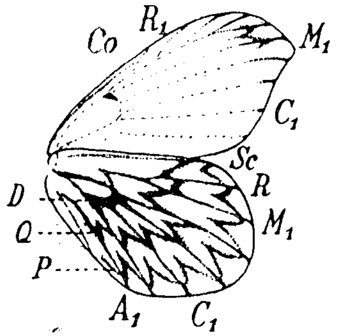

Fig. 63. Dark design of the 1st gen. of *Leptidea gigantea* LEECH 1890, the prototype of the dark dentate median-(cross-) band and marginal band on the underside of the hindwings, and of the apical mark on the upperside of the forewings of *Leptidea* species (f. Lorković).

We may notice that from the names entered into the list: *bibremis* and *bizonata* MATSUMURA 1933, *koraikola* BRYK 1946, *majorides* VERITY 1911, *mandchurica* MATS. 1938, and *sinnensis* BUTLER does not apply to *L. sinapis* but to *L. morsei*, and *vernalis* GRAESER 1888-1893 relates to *L. amurensis* MEN. 1859. The *undularis* HEWITSON 1866 is not a *Leptidea* but a palaeotropical Lycaenidae of the species-rich genus *Liptena*.

10. *Leptidea reali* ssp. *melanogyna* nov. The population of Croatia and Western Slovenia, characterized by: 1) polyvoltinism and the connected 2) strikingly black female apical spot among the summer specimens, 3) a shadowy dark pattern of the hind wing underside, and 4) an ecologic connection with *Lathyrus pratensis* as its oviposition and food plant, mostly 5) an open lowlands habitat deserves a corresponding subspecific name: *melanogyna* ssp. nov.

Type material: **Holotypus** ♀, Zagreb, Kanal 29.08.1944, breeding, (Fig. 25/28), coll. Lorković. **Allotypus** ♂, Zagreb, Maksimir, 16.06.1931, breeding, (Fig. 19/22), gen. prep. No. 1880, coll. Lorković. **Paratypes** disected: 39 ♂♂, 24 ♀♀ same and other localities: Samobor, Turopolje, Podravina (Koprivnica, Zovje), Hrvatsko near the Kupa River spring, Ljubljana and Plešivec in Western Slovenia, and the Maglić Mountain, Montenegro.

Further research may reveal whether most continental European populations, including the Swedish ones, also belong to the same subspecies.

If a more accessible distinctive marking of *L. reali* should not be found soon thousands upon thousands of collector victims will be waiting in vain for their identity cards.

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The author would like to express his thanks to number of persons who took part in this work: to the discoverer, Prof. Dr J. Réal, who made it possible for Mr. E. von Mentzer (Täby) to inspect his collection, and then brought the needed samples from the Pyrenees, to Dr. U. Eitschberger, Marktleuthen, for the numerous slides from samples in his Museum, to Dr. Wagener, Bochold, together with Mr. H. Oorschot, Amsterdam, for the same kind of work performed in Rijkmuseum van Naturlijke Historie, Leiden, to Dr. R. Kranjčev, Koprivnica, for the praiseworthy material from Podravina, to the young collaborators of the Croatian Natural History Museum, Zagreb, M. Kučinić, B. Gjurašin and F. Perović, for the dissection of one hundred samples deriving from the author's and the Museum's collection, for their help in the field work, I. Lajtner and D. Pomykalo for the photography, and to the director of the Museum Dr. N. Tvrtković for the permission to use the Museum's facilities. The author is greatly indebted to Ing. A. Marušić and to Dr. S. Leiner for their help in preparing the English manuscript.

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SAŽETAK

Leptidea reali REISSINGER 1989 (= *lorkovicii* REAL 1988) nova vrsta *Rhopalocera* u Europi (*Lepidoptera, Pieridae*)

Z. Lorković

U lipnju godine 1988. je prof. Réal iz vrste *Leptidea sinapis* LINNEAEUS 1758, jedne od najraširenijih i običnih vrsta danjih leptira, izdvojio sa visine od 1350 m Istočnih Pireneja novu vrstu *Leptidea lorkovicii,* koju je E. Reissinger već slijedeće godine preimenovao u *L. reali* zbog homonimije s *L. duponcheli lorkovici* PFEIFFER 1932. Vrsta je bila opisana u malo poznatom, lokalnom neperiodičnom časopisu za ekofaunistička istraživanja švicarskog Jura-gorja (Besançon), pa ni nakon pet godina nije bilo prave reakcije na to potpuno neočekivano otkriće.

Zbog nepotpunosti originalnog opisa i crteža je E. von Mentzer (Švedska, Täby) na prijedlog autora sabrao od 12-15. VII 1991. 12 ♂♂ i 4 ♀♀ vrste *reali* s locus tipicus La Montailla i nedalekog novog nalazišta, 1500 m visokog Mont Louis, nakon čega se moglo pristupiti savjesnijoj analizi te nove vrste u usporedbi s *L. sinapis,* s kojom je po vanjskim obilježjima gotovo jednaka, pa se obadvije posvema razilaze jedino po genitalijama.

Međutim, malo zatim taj se posao pokazao skoro suvišnim jer se uvidom u privatne i muzejske zbirke, te disekcijom ne samo ženskih nego i muških genitalija, koja do tada nisu bila poznata, ustanovilo da nova vrsta ne dolazi samo u Pirenejima, nego da je raširena diljem Europe, najmanje u Španjolskoj, a česta je u Švedskoj, Hrvatskoj, Sloveniji i Poljskoj. Zatim se otkrilo da *reali* nije isključivo montana vrsta nego isto tako ravničarska i prema tome polivoltina, s izrazitijim vanjskim oznakama u dvije ljetne generacije nego u do tada jedino poznatoj proljetnoj formi. Bila je, štoviše, već od godine 1925 nekoliko puta uzgajana u autorovu laboratoriju, čime se forma ♀- *andromorphica* Verity 1911 pokazala kao nasljedna karakteristika, a ne samo fenotipska reakcija na povišenu ljetnu temperaturu. Zatim je ustanovljeno da su osim već poznatoga gotovo dvostruko dužeg ductus bursae ženke *reali* (M=0,91 mm naprama 0,56 mm od *sinapis*, Sl. 1-4) također adekvatno mnogo duži aedoeagus i saccus mužjaka od *reali* (Sl. 5, 6). Prema tome postoji u ženskom spolu potpuna diskontinuiranost u varijabilnosti genitalija između obadviju vrsta, pa analiza genitalija osigurava uvijek točnu determinaciju. Slično vrijedi i za pozitivnu korelaciju muških organa aedoeagusa i saccusa, kako to pokazuje Tabela 3. Tako je moguće sigurno razlikovanje obadviju vrsta i u muškom spolu.

Naspram tako velikoj razlici u genitalijama na krilima su razlike tako neznatne i ujedno toliko nepostojane da samo ekstremne plusvarijante apikalne pjege ženki *reali* (pjega crna kao u mužjaka, samo manja = f. ♀ - "andromorphica" VERITY 1911 Sl. 25) i ekstremna minusvarijanta posvemašnje odsutnosti te pjege kod *sinapis* ženki (Sl. 51, f. ♀ - *erysimi* BORKENAHUSEN 1788) omogućuju donekle sigurno raspoznavanje tih dviju vrsta bez pregleda genitalija. Mužjaka *reali* može katkada odati proširenje crne apikalne pjege u žilni prostor M_2M_3.

Osim toga, kod mužjaka *reali* proljetne generacije proširuje se prednji rub apikalne pjege često prema bazi krila (sl. 7, 8, 9), ali može biti i kod *sinapis*, osobito španjolskih. Jedan takav vrlo rijetki ekstremno crnopjegi par ♂ i ♀ *reali* nalazi se u zbirci Cl. Dufay-a (Chaponost, Francuska), ulovljen u Sesvetama 17. VI. 1971.

Drugo svojstvo roda *Leptidea*, koje ne ovisi toliko o količini crnog pigmenta koliko o njegovoj rasporedbi, očituje se na donjoj strani stražnjih krila. Sastoji se od oširoke, nazubljene poprečne tamne pruge te uzdužnih tankih pruga duž žilica krila i nejasnih međužilnih trakova koji ne dopiru do ruba krila. Oblik tog tamnog crteža i temeljna boja krila su nezaobilazno obilježje vrsta roda *Leptidea*, premda sezonski jako različito, jer često posve nestaju u ljetnoj generaciji. Najizrazitije je sačuvan taj crtež kod *L. morsei*, jer se može izvesti iz osnovnog tipa crteža *Leptidea* u kineske vrste *L. gigantea* (v. LORKOVIĆ, 1950) iz elemenata kojeg sastavljena je zapravo i apikalna pjega (Sl. 63). Kod *L. reali* taj je crtež nejasniji, pa može poprečna traka sasvim nestati (Sl. 10).

Preimaginalni stadiji. Ni u mlađim razvojnim stadijima nema zamjetljivih razlika ni na jajetu, niti na gusjenici i kukuljici (Sl. 55-58). Mnogo istaknutije su, naprotiv, ekološke i etološke razlike. Sva prijašnja opažanja o ovipoziciji *L. sinapis* treba revidirati jer još malobrojna najnovija opažanja govore da bi za *L. reali* bila glavna ovipozicijska biljka *Lathyrus pratensis*, livadska graholika, za što govore i pomna istraživanja Wiklunda u Švedskoj 1977. godine. Na otoku Ingarö kod Stockholma zabilježeno je 87,3 % odlaganje jaja na tu biljku a samo jedamput na *Lotus*, ali je ta biljka tamo posve rijetka. Wiklund je svoj objekt istraživanja vodio tada dakako pod imenom *sinapis,* no na otoku vjerojatno ni nema druge vrste osim *L. reali.*

Premda već sama diskontinuiranost u varijabilnosti duljine ductus bursae ženskog genitalnog organa nedvojbeno govori o dvije vrste, uspjela je ipak i direktna potvrda seksualne izolacije između *sinapis* i *reali* time da su dvije virgine *reali*-ženke različitog podrijetla povremenim treptajem krila odbijale ustrajno udvaranje *sinapis*-mužjaka koje u jednom slučaju, uz povremene kratke prekide, nije trajalo 5-10 minuta kao normalno nego nešto manje od 3/4 sata. Začuđuje da Wiklund ne navodi treptaje krila već kopulirane ženke kao način odbijanja udvaranja mužjaka kao što je to ustanovljeno za *sinapis,* a sada i za *reali* ženke prema mužjacima druge vrste.

Neobično velika duljina ductusa bursae nađena je i kod novo otkrivene kineske vrste *Leptidea lactea* (LORKOVIĆ 1950). On je, u usporedbi sa simpatričkom vrstom *L. morsei* (Tsinlig-Shan, Tapai-Shan, 1700 - 2000 m NN), s 1,10 mm dužine gotovo dva puta duži od ductusa *L. morsei,* te isto tako ima mnogo duže muške genitalne organe (sl. 62 A-D). Slično produženje ductus bursae i aedoeagusa vrijedi i za *L. duponchelii* dok saccus nije produžen nego terminalno jako odebljao što pojačava njegovu funkciju mišića retraktora aedoeagusa. Produženje kopulacijskih organa kod 3 od 7 vrsta roda *Leptidea* čini te vrste posebno zanimljivima jer produženje predstavlja novo stečeno apomorfno svojstvo u rodu *Leptidea,* odnosno u podporodici Dismorphiinae koja je uglavnom neotropska.

Činjenica je da u mnogim dijelovima Švedske *L. reali* ima prevagu nad *L. sinapis* pa se postavlja ozbiljno pitanje kojoj od tih dviju vrsta pripada Linnéov tipus *Papilio sinapis* 1758 koji prema Verity-u potječe iz Švedske. Ako je tako, onda bi ime *sinapis* išlo vrsti s dugačkim aedoeagusom i saccusom, a ime *reali* bi palo u sinonimiju pa bi za dosadašnju vrstu *sinapis* s kratkim genitalijama trebalo naći novo ime među eventualnim starim dosadašnjim sinonimima od *sinapis* ili od nekog supspecijesa, kao što je npr. ssp. *corsica* VERITY, 1911.

Kako je populacija u Hrvatskoj, za razliku od montane pirenejske, pretežno nizinska, s dvije do tri generacije godišnje, a ženke ljetne generacije se ističu crnom apikalnom pjegom, može se ta populacija smatrati podvrstom pa se imenuje *Leptidea reali* ssp. *melanogyna* nov. **Holotip** ♀, Zagreb, Kanal 29.08.1994, (sl. 25), coll. Lorković. **Alotip** ♂, Zagreb, Maksimir, 16.06.1931 (sl.. 19), gen. prep. No. 1880, coll. Lorković. **Paratipovi** 39 ♂♂, 24 ♀♀ s istih i drugih lokaliteta: Samobor, Turopolje, Podravina (Koprivnica), izvorište rijeke Kupe, te Podvrh (Osilnica), Plješivec i Ježica kod Ljubljane u Sloveniji te Trnovačko jezero na Magliću, Crna Gora.

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