

On the cytotaxonomical relationship in *Leptidea* (Lepidoptera-Rhopalocera)

Kōdō MAEKI

Biological Laboratory, Kwansei Gakuin University

Received July 7, 1958

UDC: 595.78:576.312

The taxonomy, variation and distribution of butterflies have been dealt with by a number of lepidopterists on the basis merely of morphological characters. Recently, chromosome cytology has contributed significantly to insect systematics by emphasizing the cytotaxonomic differences which exist between related species. Cytologists are concerned with differences between species in chromosome number or in the sizes and shapes of some of the chromosomes, since such differences may sometimes be useful to distinguish cryptic species that cannot be separated on external characters.

In recent years some cytotaxonomical contributions have been made by the present author to some groups of lepidopterous insects in correlation with the known morphological relationships of these species. In the present paper, it is proposed to present some cytotaxonomical evidence which involves the following two Japanese species of the family Pieridae: *Leptidea morsei* Fenton, and *Leptidea amurensis* Menetries.

The following investigations were based on testicular material preserved in Allen P.F.A. -3 solution and Allen-Bouin mixture. Following the usual paraffin method, sections were stained with Heidenhain's iron-haematoxylin with counterstaining of light green.

Leptidea morsei has a wide distribution through the northern parts of the old world, ranging from Central Europe to Siberia, Amur, Ukraine, parts to the east of Lake Baikal, Tibet, western and northwestern parts of China, and Hokkaido (Japan). *Leptidea amurensis* is distributed in Siberia, Altai range, Baikal, regions east of Lake Baikal, Amur, north and northwestern parts of China, Manchuria, and Japan. In Japan, *Leptidea morsei* occurs in Hokkaido only, while *L. amurensis* is abundant in the plains of Hokkaido and of the north-eastern parts of Japan-Hondo. This species also inhabits mountainous regions of southern Japan except Shikoku.

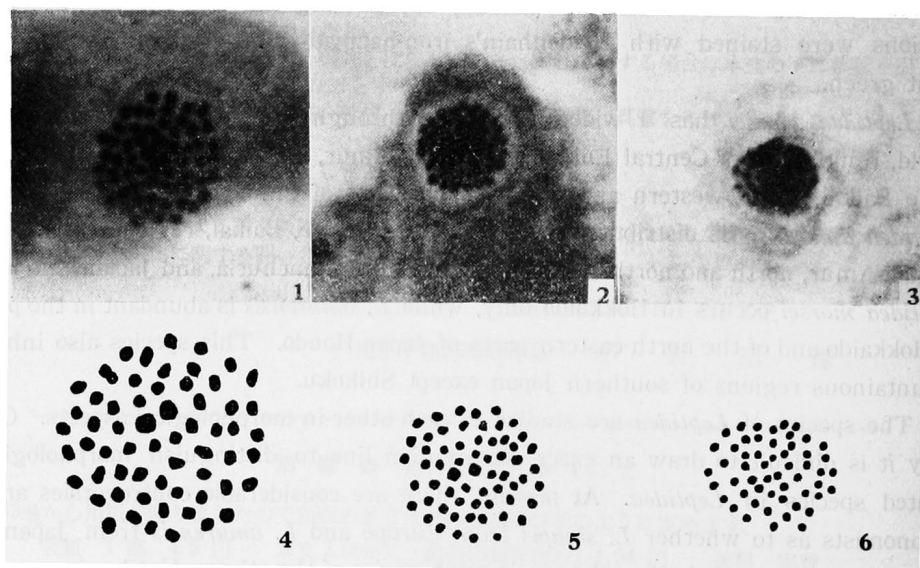
The species of *Leptidea* are similar to each other in morphological aspects. Generally it is difficult to draw an exact demarkation line to distinguish morphologically related species in *Leptidea*. At present there are considerable controversies among taxonomists as to whether *L. sinapis* from Europe and *L. amurensis* from Japan are different species, or whether the one is a subspecies of the other. Until quite recently, *Leptidea morsei* was treated as a subspecies of *Leptidea sinapis* having the name, *Leptidea sinapis morsei*. Thanks to the cytotaxonomical investigation by Lorkovic

('41, '50) of European species, it was made clear that the butterflies named *L. sinapis* comprise the following two different species, *L. sinapis* and *L. morsei major*. These two species are similar in the structure of genitalia, a sharp distinction between them being very difficult. It is stated that hybridization has never occurred between the two species even in the locality of a mixed population.

Cytologically, *L. sinapis* shows an individual variation of the chromosome number which ranges from 28 to 41 in haploid. Further noticeable evidence is that some chromosomes of the complex assume a V- or cylinder-shape. *Leptidea morsei major* is characterized by 54 dot-like chromosomes. F_1 hybrids between *L. sinapis* and *L. morsei* were produced in the laboratory, but they were all sterile (Lorkovic '50). On these bases, Lorkovic ('50) separated *L. morsei major* from *L. sinapis*.

It is a view of Lorkovic ('50) that a Japanese species described as *L. sinapis morsei* may be *L. morsei major* considered from its morphological characters. Here a question arises whether the chromosomes of the Japanese species under consideration are similar or dissimilar to those of the European species, *L. morsei major*. In view of the revision of the taxonomical relationship between such species of *Leptidea* as *sinapis*, *morsei* and *amurensis* the investigation of their chromosomes is of significance and much needed. Observations were undertaken to answer the above question; the author's findings are presented as follows:

Leptidea morsei (or *L. sinapis morsei*) was found to possess 54 dot-like chromosomes in haploid. They are isomorphic in complex being made up of dot-like elements of nearly similar size (Figs. 3, 6). The author's findings on *L. morsei* from Japan are in complete agreement with those reported in *L. morsei major* by Lorkovic ('41, '50).



Figs. 1-6. Chromosomes of *Leptidea amurensis* and *Leptidea morsei*. 1, 4: *Leptidea amurensis* (I). 2, 5: *Leptidea amurensis* (II). 3, 6: *Leptidea morsei morsei* (I). (I), 1st spermatocyte. (II), 2nd spermatocyte. (1-3, $\times 2500$. 4-6, $\times 3600$).

It should be further pointed out that the chromosomes of the Japanese species named as *L. morsei* (or *L. sinapis morsei*) differ greatly from those of the European species, *L. sinapis*, in number of chromosomes as well as in other morphological respects. Cytological evidence here presented is in favor of, or supports the view of Lorkovic ('50) based on the morphological study.

Leptidea amurensis is characterized by chromosomes with a somewhat angular outline (Figs. 1, 2, 4, 5). In this respect the present species is rather exceptional in the Rhopalocera, since the great majority of lepidopterous species possess chromosomes of round or oval shape. Further, this species is also particular in respect of the chromosome number, since it shows the haploid number of 61. It is also remarkable that there are two "Sammelchromosomen" in the haploid complex. All the cytological features as mentioned above indicate with certainty that *L. amurensis* is a species distinctly different from *L. sinapis* as well as from *L. morsei*.

In the following, the author wishes to give a summary of the cytotaxonomical features found in *Leptidea duponcheli*, *L. morsei*, *L. sinapis*, and *L. amurensis*, based on the accounts furnished by Beliajeff ('30), Federley ('38), Lorkovic ('41) and the present author. In respect to the haploid number of chromosomes they differ considerably from one another, there being 104 in *L. duponcheli*, 54 in *L. morsei*, from 28 to 41 in *L. sinapis*, and 61 in *L. amurensis*. In comparison of the chromosomes themselves between the above species, it is evident that *L. sinapis* is outstanding among them not only in its chromosome number but also in the type of the chromosomes. In the present species there occurs an individual variation of chromosome number which varies from 28 to 41. Further, the chromosome complex of this species is rather unique among butterflies in the point of containing some elements which are V- and cylinder-shaped.

It is interesting to learn that there is a variety of karyotypes among the species of *Leptidea*.

The author wishes to acknowledge his great indebtedness to Professor Sajiro Makino, Hokkaido University, for expert guidance and kind help in connection with the preparation of the manuscript. Sincere thanks should be extended also to Professor Yoshio Ojima of this laboratory, the late Professor Teiso Esaki, Kyushu University and Professor Z. Lorkovic, Zagreb University, for their valuable advice and kind aid.

Literature

- Beliajeff, N.K. 1930. Die Chromosomenkomplexe und ihre Beziehung zur Phylogenie bei den Lepidopteren. Z.I.A.V. 54.
 Federley, H. 1938. Chromosomenzahlen Finländischer Lepidopteren. Hereditas 24.
 Lorkovic, Z. 1941. Die Chromosomenzahlen in der Spermatogenese der Tagfalter. Chromosoma. 2.
 Lorkovic, Z. 1950. Neue ostasiatische Arten und Rassen der Gattung *Leptidea* nebst Nomenklaturberichtigungen. Glasnik II B.
 Makino, S. 1956. An atlas of the chromosome numbers in animals. Revised ed. Hokuryukan, Tokyo.