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REVISION OF THE FAMILY OPPIIDAE GRANDJEAN 1953
(ACARINA, ORIBATEI)

BY

STANISLAW SENICZAK *

INTRODUCTION

Species of the family Oppiidae, common in various habitats, live first of all in soil, but can also be found in trees, shrubs and plants of the herb layer. Some of them, particularly *Oppiella nova* (Oudem.), *Oppiella minus* (Paoli) or *Oppiella obsoleta* (Paoli), are fairly dense in some soils and, therefore, are an important component of mite agglomerations.

Species of the family Oppiidae occur in different horizons of soil, some of them being more numerous in the upper horizons, rich in organic substances, others — in the lower, mineral-humose layers. There is a certain correlation between the shape of the specimens and the depth of their occurrence. According to the observations of KARG (1961), big and stocky species usually live closer to the soil surface, where soil holes are larger, whereas small and slender species occur in the lower horizons with fine pores.

Data from literature and the observations of the author show that most species of the family Oppiidae in Poland feed mainly on myxoselenium, some species feed on algae, lichen, rotten leaves, humus, and *Oppia nitens* C. L. Koch even on carrion.

The taxonomy of the family Oppiidae, though recently extensively worked out, arouses some doubts. These particularly concern diagnostic features of genera. These features are: the sculpture of propodosoma and hysterosoma, sensillus shape, the number of genital setae, the development degree of the setae ta, as well as the number, size and shape of setae on propodosoma and hysterosoma. However, the hierarchy of these features is not ascertained; some genera are distinguished by their skeleton sculpture, others by the number and shape of setae on the notogaster.

There is also a lack of exclusive features for individual genera. That creates difficulties with referring of even common species, described long ago, to a proper genus, if they have, to a larger or smaller degree, features of two or more genera. In doubtful cases a species is included in the "genus" Oppia, whose diagnostic features are poorly defined and as a matter of fact concern the whole family Oppiidae.

In the well-known key of SELLNICK (1960) the family Oppiidae, in Grandjean’s understanding (1953), is represented by one genus Oppia C. L. Koch, although already at that time other genera included in that family were described (Trizetes Berlese, Oppiella Jacot, Quadroppia Jacot, Granuloppia Balogh, Hexoppia Balogh, Striatoppia Balogh, Tetratoppia Balogh, Mystroppia Balogh, Lasioelba Aoki). SELLNICK did not recognize these genera. Even BALOGH (1961, *Department of Soil Science, Copernicus University, ul. Sienkiewicza 30, 87-100 Toruń, Poland.

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for a certain time did not recognize the genus Oppiella Jacot, considering it a synonym of Oppia C. L. Koch.

The establishment of the genera Oppiella and Quadroppia by Jacot (1937, 1939) on the basis of differences in the structure and sculpture of chitinous skeleton, omitting a precise diagnosis of setation, directed taxonomic studies in a wrong direction. Although Balogh (1958) began descriptions of new genera from the setation on the notogaster, he mentions only large setae. Besides, that author recognized the sculpture of epidermis, the shape and number of genital setae as generic characters. Later descriptions of genera contained more and more accurate diagnoses concerning the sculpture of epidermis, sensillus shape, the shape and number of setae and so on. It is not surprising that the acceptance of many various features as criteria for the division of the family Oppiidae resulted in distinguishing many genera in this highly varied group of mites. Therefore, new genera were created on the basis of definite characters without certainty that these characters were systematically more important than specific characters.

Many taxonomists realized that the genus genus Oppia C. L. Koch was not uniform and required revision. Studies on the fauna of mites outside the European Continent, especially in Africa, South America, Asia and New Zealand, revealed a number of new species, which considerably differed from European species. It was difficult to include them in the species-rich genus Oppia. Therefore, a division of that “genus” was necessary.

The number of new genera in the family Oppiidae was rapidly increasing owing to the works by Balogh (1958, 1959, 1961 a, b, 1962, 1965, 1970), Hammer (1961, 1962, 1968), Csiszár (1961), Wallwork (1961), Balogh and Mahunka (1961 a, b, 1968) and others. The increase in the number of these genera is illustrated by the following figures:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of genera known</th>
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<tbody>
<tr>
<td>1836</td>
<td>1</td>
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<td>1904</td>
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<td>1969</td>
<td>48</td>
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<td>1970</td>
<td>51</td>
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But the establishment of so many new genera in the family discussed did not remove difficulties in the taxonomy of that group of mites. On the contrary, the inclusion of some species in appropriate genera became even more troublesome. Some taxonomists (Hammer 1962, Kox 1969, Moritz 1969) pointed out that the oldest and most species-rich genus Oppia was still not uniform and required detailed investigation.

In his key "The oribatid genera of the world" Balogh (1972) gathered diagnostic features of 51 genera from the family Oppiidae, which he divided into 5 groups, depending on the sculpture of propodosoma and hysterosoma. In that way the author emphasized the importance of the skeletal sculpture from the point of view of taxonomy, though he stipulated in the introduction, that the arrangement of the key was dictated first of all by practical reasons for facilitation of identification. While analysing taxonomic features of most genera, it can be noticed that these
features are too much restricted and concern usually the skeletal structure of adult specimens of species typical of genera. The lack of justification of the importance of generic characters in the hitherto accepted division by ontogenetic or phylogenetic conclusions indicates that it does not reflect relationships between species.

With that in view I undertook studies of 16 Polish species, which belong to the family Oppiidae. I was concerned with the examination of morphology of all developmental stages of these species and tried to find significant characters dividing both juvenile forms and adult specimens into definite groups. According to the present tendencies in the taxonomy of mites I laid great stress on an important systematic feature — different setation of species. I also searched for a connection between the species’ morphological structure and their different behaviour in the environment.

While previous criteria of division of the family Oppiidae into genera were based on many doubtful generic characters of adult specimens, the new division is based on a uniform criterion — differential setation — and concerns both juvenile and adult specimens. Thus the new division is supported by ontogenetic observations. If we assume after Grandjean (1956, 1962) that in the process of phylogenesis setae on the notogaster of adult specimens are reduced, the division of the family Oppiidae into subgroups on the basis of different setation of the notogaster is also phylogenetically justified. Moreover I found a correlation between different setation of legs of juvenile forms (and notogaster of adult specimens) and their different behaviour in the environment (a different way of moving the first pair of legs).

**TAXONOMIC FEATURES OF THE FAMILY OPPIIDAE GRANDJEAN 1953 AND THE HITHERTO ACCEPTED CRITERIA OF ITS DIVISION INTO GENERA.**

A typical species of that family is *Oppia nilens* C. L. Koch. The genus *Oppia* C. L. Koch was previously included in the family Dameosomiidae (Oudemans 1923) or Eremaeidae (Wilmann 1931).

Grandjean (1953) distinguished the family Oppiidae on the basis of morphology of juvenile and adult specimens. That author, however, studied only juvenile forms of big species. His diagnosis of that family is as follows: "Je n’ai étudié complètement dans cette famille qu’une grande espèce d’Oppia. Sur les petites espèces et leur développement mes observations se réduisent à peu de chose. Je désigne par *Oppia*, dans ce qui suit, la grande espèce."

Nymphes unidéficientes. CaE. Ng (9 ou 10). G (1—2—4—5) (Oppia). Une autre formule G se termine par 4. AT2 ou PPa ; les paraproctes larvaires ont toujours des poils ; ceux des proto- et des deutonymphes portent des très petits poils, ou des vestiges, ou ne portent rien. PF dev (Oppia) ou PF lv. Acm L. DDC n3 ou DDC el. N1 (0—0—0—0—5) (Oppia). Les poils proraux des pattes II-III-IV ont disparu à toutes les stases (Oppia). Monodactylie."

The author’s explanation:

"CaE — signifie qu’il n’y en a pas (bord entier).
Ng — est le notogaster. Suivi d’un nombre entre parenthèse Ng veut dire que le notogaster a ce nombre de paires de poils. Ng (10), par exemple, signifie que le notogaster a 20 poils. Tous les poils sont comptés, même s’ils sont vestigiaux, même s’ils sont réduits à leurs alvéoles, pourvu qu’ils soient constants ou que la probabilité de leur présence soit beaucoup plus grande que celle de leur absence.
G — précède la formule ontogénétique des poils génitaux.
AT2 — est l’atrichosie à 2 niveaux, c’est-à-dire aux stases proto- et deutonymphale.
PPa — veut dire qu’il y a des poils aux paraproctes à toutes les stases.
PF dev — signifie qu’il apparaît au cours du développement, ou qu’il manque toujours.
PF lv — signifie que ce poil est présent dès la stase larvaire."
Acm L — veut dire que le poil acm (eupathidique ou non) est libre à la stase adulte, c'est-à-dire n'est pas associé au solénidion.

DDC — désigne les poils dorsaux des genuaux et tibias, aux pattes, lorsqu'ils sont compagnons, c'est-à-dire accouplés à des solénidion. σ ou φ.

DDC n3 — veut dire que ces poils persistent seulement jusqu'à la stase tritonymphale.

DDC el — veut dire que ces poils ont disparu (qu'ils sont éliminés) à toutes les autres states.

N1 — précède la formule des poils de la 4e patte, à la stase protonymphale. La formule N1 (0–0–0–0–7) est dite normale.

Diagnostic features of the family Oppiidae are based mainly on the representatives of the genus Oppia C. L. Koch. For that reason the criterion of the notogaster setation is too narrow (9 or 10 pairs of setae).

If we accept an accurate interpretation of Grandjean’s diagnosis, we can include in the family Oppiidae only species whose adult specimens have 9 or 10 pairs of setae on the notogaster (Amerioppia, Brachioppia, Mystroppia, Machuella, Oppia, Oppiella, Quadroppia and others). This family does not include genera with more pairs of setae on the notogaster (Multioppia and Gittella have 12 pairs of setae on the notogaster of adult specimens, Aeroppia and Polyoppia have 13 pairs of setae). However, the above genera were described after the separation of the Oppiidae family by Grandjean and are included in it (Hammer 1962, Moritz 1969, Kunst 1971, Balogh 1965.

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Fig. 1: Oppia nitens C. L. Koch;
A. — (× 360) tritonymph, dorsal view;
B. — (× 425) adult, dorsal view.
The criterion of setation of the Oppiidae family should, therefore, be extended, because its representatives have 9-13 pairs of setae on the notogaster of adult specimens.

Grandjean's genital formula is also too narrow (adults have 5 or 4 pairs of genital setae). There are species (Oppiella gilva (Wallwork), O. fenestralis (Wallwork), O. tenuiseta (Wallwork) and others), which have 6 pairs of genital setae. WALLWORK (1961) mentions a partial revision of systematic features of family Oppiidae: "GRANDJEAN (1953) has considered the possession of five pairs of genital setae to be a characteristic of the genus Oppia, although he notes that some species may only have four pairs. The taxonomic value of number of genital setae is uncertain at present; the following species are retained in the genus pending a detailed revision of the family Oppiidae”.

In the present taxonomy the sculpture of epidermis, sensillus shape, the form of pores iad and setation characters are considered the main criteria of the division of the family Oppiidae into genera. These characters were accentuated by JACOT (1937, 1939) in his description of genera Oppiella and Quadroppia and were considered most important by BALOGH (1972), who divided the group Oppioid-Type into 5 basic groups depending on the sculpture of propodosoma (costula) and the anterior margin of notogaster (crista) of adult specimens.

Only HAMMER (1961, 1968) emphasizes the importance of setation as the main feature of the genera Multioppia, Gittella, Aeroppia and Polyoppia, although this character is not exclusive

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**FIG. 2:** Multioppia glabra (Mihelčič);
A. — (× 535) tritonymph, dorsal view;
B. — (× 532) adult, dorsal view;
C. — fragment of the body margin.
for the genera (Multioppia and Gittella have 12 pair of setae on the notogaster and Aeroppia and Polyoppia have 13 pairs of setae).

DIFFERENTIAL STATION OF JUVENILE FORMS IN THE FAMILY OPPIIDAE AS THE BASIS OF THEIR DIVISION INTO SUBGROUPS.

Larvae and nymphs of the family Oppiidae have a delicate epidermis, in consequence of which their colour is whitish. Their body is covered with dense, short, cone-shaped structures (Fig. 2 C), which makes it seem densely punctured. In the process of development the degree of skeletal chitinization does not change much. Even in tritonymph it is difficult to perceive sutures, area porosae, glands and so on. Also juvenile forms have no sculpture of the skeleton, which is characteristic of adult specimens.

Sensillus of juvenile specimens has a thorny head and is not similar to that of adult specimens (Fig. 1, 2, 3).

Setation changes in the course of individual development, quantitative changes in setation except the setation of legs and genital area being identical in all species under study. The shape and mutual proportions of the setae length are characteristic of species.

![Fig. 3: Oppiella nova (Oudemans)](image)

A. — (× 730) tritonymph, dorsal view
B. — (× 702) adult, dorsal view.

The juvenile stages studied differed significantly from one another by the setation of their legs. One group which contained the species Oppia nitens C. L. Koch typical of the genus Oppia
C. L. Koch had less setae on the legs than the second group with the species typical of the genus *Oppiella* Jacot — *Oppiella nova* (Oudemans). Since these differences are important for the new division of the family Oppiidae, I would like to discuss differences in setation of legs of species typical of the genera *Oppia nitens* and *Oppiella nova*.

Juvenile forms of *Oppia nitens* differ from juvenile stages of *Oppiella nova* by the length and shape of solenidia on the legs and by different setation of trochanters and femurs in the process of development. Solenidia \( \sigma \) of the first pair of legs, \( \sigma \) and \( \varphi \) of the second and third pairs of leg, as well as solenidia \( \varphi \) of the fourth pair of legs of *Oppia nitens*, are long and setashaped, whereas those of *Oppiella nova* are short, obtusely ended and some are even thickened at the end. *Oppiella nova* have protection setae (d) at these solenidia, which are lacking in *Oppia nitens* (Fig. 4).

Fig. 4: Setation of the tritonymph's legs (x 860);
I--- IV — *Oppia nitens* C. L. Koch;
A. — D — *Oppiella nova* (Oudemans).

The deutonymph of *Oppia nitens* also has a different number of setae on the trochanter and femur from that of *Oppiella nova*, although the setation of these parts of legs in the tritonymphs of these species is similar. In the deutonymph of *Oppia nitens* there is one seta on the femur of the first, second and third pairs of legs, whereas in *Oppiella nova* these setae grow only on the femur of the third pair of legs. But the trochanter of the first, second and third pairs of legs of *Oppiella nova* has one seta more than the analogous parts of legs in *Oppia nitens*. 
The setation of legs similar to that of *Oppia nitens* was found in the juvenile forms of the following species:

- *Oppia fasciata* (Paoli)
- *Oppia "I"*
- *Multioppia glabra* (Micheliè)
- *Multioppia excisa* Moritz.

The setation of legs similar to that of *Oppiella nova* was also found in the juvenile stages of the following species:

- *Oppiella bicarinata* (Paoli)
- *Oppiella falcata* (Paoli)
- *Oppiella minus* (Paoli)
- *Oppiella neerlandica* (Oudemans)
- *Oppiella obsoleta* (Paoli)
- *Oppiella ornata* (Oudemans)
- *Oppiella quadricarinata* (Michael)
- *Oppiella subpectinata* (Oudemans)
- *Oppiella translamellata* (Willmann)
- *Oppiella "I"*.

Besides different setation, which divides the species under study into two separate morphological subgroups, juvenile stages differ also by convexity of the notogaster. In young juvenile forms of the first group with *Oppia nitens* the notogaster is less convex, and roughly along the line of setae c₂, la, lm and lp there are longitudinal groove-like depressions. Before moult the above differences in the structure are not seen.

In adults of the species studied setae on the notogaster and legs were reduced. In *Oppia nitens*, *Oppia fasciata* and *Oppia "I"* that reduction concerned all frontal setae (c₁, c₂ and c₃) and dorsal setae (da, dm and dp) and there remained only the alveolus of setae c₂. In *Multioppia. glabra* and *M. excisa* only frontal setae were reduced and there was also an alveolus of seta c₂.

In the remaining species frontal setae (c₁ and c₃) and dorsal setae (da, dm and dp) were reduced. These species in their adult form have no protection setae at the solenidia of legs, although in juvenile forms these setae do occur.

**DIFFERENTIATION OF SETATION AS A NEW CRITERION OF THE DIVISION OF THE FAMILY OPPIIDAE INTO SUBFAMILIES AND GENERA IN THE LIGHT OF ONTOGENETIC STUDIES.**

Species belonging to the family Oppiidae differ by the setation of notogaster of adult specimens. Most species have 10 pairs of setae, some species have 9, 12 or 13 pairs of setae on the notogaster. In literature there are species having less than 9 and more than 13 pairs of setae on the notogaster.

As it has been already mentioned, seemingly similar juvenile forms of species of the family Oppiidae differ from one another by significant features, mainly by the setation of some segments of their legs. The differences observed in the setation of legs show no connection with the variable sculpture of the skeleton of adult forms, with different sensillus shape or different number of genital setae, i.e. with characters commonly recognized as the most important criteria of the division of the family Oppiidae into genera.

An example of this are the species *Oppiella nova* and *O. subpectinata*, which appeared to be in one group, though they significantly differ from one another by the sculpture of their skeleton. Similarly, species which significantly differ by the shape of sensillus (*Oppiella subpectinata*, *O. ornata*, *O. bicarinata*), are also in one group.

However, it has appeared that the setation of legs of juvenile forms shows a close connec-
tion with the setation of notogaster of adult specimens. Groups of species which in the juvenile form have no protection setea at solenidia of their legs have no setae ta (c) in the adult form either. Another group of species which in the juvenile form have protection setae at solenidia have setae ta on the notogaster also in the adult form.

It may, therefore, be assumed that the presence or lack of setae ta on the notogaster of adult specimens is the most important criterion of the division of the family Oppiidae into lower taxonomic units, since this character coincides with different setation of legs of juvenile forms and with different walking behaviour.

The above division of species of the family Oppiidae into two separate morphological groups is supported by different behaviour in the environment. Adult and juvenile specimens of the group including Oppia nitens agitate their first pair of legs before touching the ground (O. nitens rarely displays this reflex, whereas a good object for observations are Oppia fasciata and Multioppia glabra). The second group of species, including Oppiella nova, walk without agitating the first pair of legs.

The acceptance of the presence or lack of setae ta on the notogaster of adult specimens as the main criterion of the division of the family Oppiidae into subgroups, reverses at the same time the hierarchy of importance of the characters accepted by BÁLOGH (1972).

A group of species without setae ta on the notogaster was represented by species having 9 and 12 pairs of setae. If we assume after Grandjean (1956, 1962) that in the process of phylogensis first setae c_5 and c_4, then dorsal setae (da, dm and dp) and last of all setae c_4 (ta) are reduced, species with 9 pairs of setae are more advanced in their development than species with 12 pairs of setae on the notogaster. The presence or lack of setae ta is also a more important taxonomic feature than the presence or lack of dorsal setae.

The presence of absence of setae ta is, therefore, a criterion of division of the family Oppiidae into two subfamilies, whereas the presence or absence of dorsal setae on the notogaster of adult specimens is a generic character.

In the light of the new criteria of division of the family Oppiidae the subfamily characters are perceivable in all developmental stages. In juvenile forms their inclusion in a definite subfamily is determined by the absence or presence of protection setae at the solenidia of the legs, whereas adult specimens are referred to appropriate subfamilies on the basis of the absence or presence of setae ta on the notogaster. Generic characters are perceivable only in adult specimens, since they concern a reduction of dorsal setae on the notogaster. Dorsal setae occur in the juvenile forms of the family discussed. Specific characters are perceivable in all developmental stages, they are not, however, identical in juvenile and adult specimens. Adult specimens first of all vary in the sculpture of the skeleton, in the sensillus shape, in the shape and arrangement of pores, in the number of genital setae, the length and shape of other setae, the size and form of the body and so on. Juvenile forms differ in the length and shape of setae and in mutual proportions of the lengths of some setae, in the length of sensillus and shape of its head, in the size and shape of the body and the size of the cone-like formations covering the skin.

REVISION OF THE FAMILY OPPIIDAE GRANDJEAN 1953.

On the basis of various setation of legs of juvenile forms displayed in adult specimens by the presence or absence of setae ta on the notogaster we can divide species of the family Oppiidae into two subfamilies:

Genera belonging to this subfamily have no setae ta on the notogaster of their adult specimens, there are only alveoli of these setae. Juvenile forms of these genera have no protection setae at solenidia σ of the first pair of legs, at solenidia σ and ϕ of the second and third pairs and solenidia ϕ of the fourth pair of legs. Juvenile forms and adult specimens agitate their first pair of legs while walking (Oppia nitens rarely displays this reflex).

This subfamily is represented by two genera: Oppia C. L. Koch and Multioppia Hammer.

1.1. Genus Oppia C. L. Koch 1836.

A species typical of that genus is Oppia nitens C. L. Koch. C. L. Koch gave a very general diagnostic description of the genus Oppia, which permitted to include in it most species of the family Oppiidae. That description has been made more precise by many taxonomists, but it was always the characters of the skeleton sculpture that were stressed. In one of the latest descriptions (Koch 1967), however, there is no precise definition of setation of the notogaster ("Nine or ten pairs of notogastral setae are present, of which setae ta are either absent or small and inserted on the anterior border of the notogaster.").

In the light of the new criteria of division genus Oppia has the following diagnostic description: there are no setae ta on the notogaster of adult specimens, there occur only alveoli of these setae. Apart from these alveoli of setae there are 3 pairs of lateral setae (la, lm and lp), 3 pairs of posterior setae (h₁, h₂ and h₃) and 3 pairs of pseudoanal setae (p₁, p₂ and p₃) — 9 pairs of setae in all. This setation characterizes the typical species of the genus — Oppia nitens C. L. Koch (Fig. 1).

The species O. fasciata (Paoli) and Oppia ′′ α ′′ had similar setation. Oppia concolor (C. L. Koch) probably also belongs to the same genus. According to Sheereef (1974), juvenile and adult individuals of this species move the tarsus of the first legs laterally outwards and inwards when walking.

The setation of notogaster in adult individuals of O. concolor is typical of this genus, it is therefore to be expected that the juvenile forms of this species have on their legs seta-like solenidia without protection setae.


A typical species of that genus is Multioppia radiata Hammer. Hammer (1961) gave the following diagnostic description of that genus: "Multioppia belongs to the Oppiidae, but deviates among other characters in having many hairs (12 pairs) on the hysterosoma (hence the name). The rostral hairs are feathered. Lamellae are absent, but faint and indistinct thin lateral lines mark the boundaries of a middle field, which is marked anteriorly also by a thin line, posteriorly it reaches the anterior margin of the hysterosoma. This middle field is usually a greyish colour; in its posterior part are the posterior light spots. The pseudostigmatic organs have branches radiating from the posterior borders of the compressed clavate head. The hysterosoma is elongate, an oval. The lateral projection between legs III and IV ends in a sharp tooth. The fissure at the anal field is situated close to the border of the latter and is parallel to the border."
In the light of the new criteria of division of the family Oppiidae it seems justifiable to separate the genus Multioppia on the basis of the presence of 12 pairs of setae on the notogaster. I am not convinced, however, whether it is right to include skeletal sculpture or sensillus shape in the generic diagnosis. This leads to the breaking up of the division (Multioppia, Gittella) on the basis of unconvincing characters. This is supported by the fact that such characters of sculpture and such sensillus shape as Hammer considers to be peculiar to the genus Multioppia can be also found in other species of the genera Oppia and Oppiella.

For that reason I consider that the diagnostic description of the genus Multioppia should be as follows: there are no setae ta on the notogaster of adult specimens, only alveoli of these setae. Moreover, there are 3 pairs of dorsal setae (da, dm and dp), 3 pairs of lateral setae (la, lm and lp), 3 pairs of posterior setae (h1, h2 and h3) and 3 pairs of pseudoanal setae (p1, p2 and p3) — 12 pairs of setae in all.

Of the species examined *Multioppia glabra* (Mihelčić) (Fig. 2) and *M. excisa* Moritz belong to that genus.

### 2. Subfamily Oppiellinae nov. subfam.

Species belonging to that subfamily have setae ta on the notogaster of adult specimens, whereas their juvenile forms have protection setae at solenidia σ of first pair of legs, at solenidia σ and φ of the second and third pairs of legs and at solenidia φ of the fourth pair of legs. Juvenile and adult specimens walk without agitating their legs.

These species constituted one genus Oppiella Jacot.


A typical species of that genus is *Oppiella nova* (Oudemans) (= *Dameosoma corrugatum* Berlese). Jacot (1937) gave the following diagnostic characters of the genus discussed: “differs from Oppia in that the notogaster is moderately arched, often with anterior band more or less raised as a ridge, bearing eighteen bristles, often with an additional pair on anterior peripheral band; sides of thorax above legs II and III usually smooth or with a few low ridges; cephalothorax often with conspicuous knobs or/and ridges; tectopedia II variously developed.”

That author does not define univocally the setation of the genus Oppiella, and neither does Hammer (1962). Kok (1967) and Balogh (1972) reported that the genus Oppiella had 10 pairs of setae on the notogaster, including setae ta.

Taking into account the new criteria of division of the family Oppiidae, the diagnostic description of the genus Oppiella is as follows: there are setae ta on the notogaster of adult specimens, moreover, there occur 3 pairs of lateral setae (la, lm and lp), 3 pairs of posterior setae (h1, h2 and h3) and 3 pairs of pseudoanal setae (p1, p2 and p3) — 10 pairs of setae in all. This setation can be found in the species *Oppiella nova* (Oudemans), typical of the genus (Fig. 3).

Of the species studied this genus includes also: *Oppiella bicornata* (Paoli), *O. falcata* (C. L. Koch), *O. minus* (Paoli), *O. neerlandica* (Oudemans), *O. obsoleta* (Paoli), *O. ornata* (Oudemans), *O. quadricarinata* (Michael), *O. subpectinata* (Oudemans) and *O. translamellata* (Willmann).
Remarks.

In the present paper the morphology of juvenile forms and adult specimens of representatives of 3 genera have been studied. There is also genus Aeroppia Hammer, which has 13 pairs of setae on the notogaster, including setae ta. On the basis of new criteria of division of the family Oppiidae the genus Aeroppia should be included in the subfamily Oppiellinae. Then the key for subfamilies and genera of the family discussed will be as follows:

**Key for Subfamilies and Genera of the Family Oppiidae.**

1 (4). There are no setae ta on the notogaster of adult specimens (there are only alveoli of these setae). Juvenile specimens have setaceous solenidia of the first pair of legs, solenidia of the second and third pairs and solenidia of the fourth pair of legs; they have no protection setae.

2 (3). 9 pairs of setae on the notogaster of adult specimens. Genus Oppia C. L. Koch 1836

3 (2). 12 pairs of setae on the notogaster of adult specimens. Genus Multioppia Hammer 1961

4 (1). Setae ta on the notogaster of adult specimens present. Juvenile specimens have protection setae at solenidia of the first pair of legs, solenidia of the second and third pairs and at solenidia of the fourth pair of legs.

Subfamily Oppiellinae nov. subfam.

5 (6). 10 pairs of setae on the notogaster of adult specimens. Genus Oppiella Jacot 1937

6 (5). 13 pairs of setae on the notogaster of adult specimens. Genus Aeroppia Hammer 1961

The new division of the family Oppiidae is then much simpler than the previous one and permits the inclusion of juvenile specimens in appropriate subfamilies. New criteria of division of the family discussed were established on the basis of scanty material, namely on the basis of morphological features occurring in Poland. These studies have certainly not exhausted all possible cases. For that reason further investigations, particularly on the genus Aeroppia, are urgently required. Studies on the development of non-European species may lead to the distinction of more genera or even subfamilies.

The new division of the family Oppiidae into subfamilies and genera requires a critical attitude to the hitherto accepted genera. These genera are listed in Tab. 1. Depending on the diagnosis of setation of the genus or of the typical species, each genus was classified to appropriate group. The table does not include such genera as Heteroppia Balogh, Miroppia Hammer, Octoppia Balogh et Mahunka and Ramuloppia Balogh, since the diagnoses of their setation are incomplete or do not correspond to the recognized genera. This also concerns the genus Yungaseremaeus Balogh et Mahunka, which has 9 pairs of setae on the notogaster including setae ta.

The inclusion of the previously described genera in one of 4 genera in this paper on the basis of the diagnosis of setation of adult specimens of the hitherto known genera does not solve the problem in the taxonomy of the family Oppiidae; it is only a logical consequence of the acceptance of a new division of the family. Juvenile stages at least of the species typical of the hitherto distinguished genera should be studied and an attempt should be made at finding confirmation of the correlations observed in this work. It may be that some genera, especially those which have less than 9 pairs of setae on the notogaster, after a thorough investigation will appear outside the family Oppiidae. Such studies may also result in the inclusion in the family Oppiidae of other genera outside this family (e.g. Sternoppiiidae) whose setation seems to be similar to that of the family Oppiidae.
Synonymization of former genera from the point of view of the new criteria of division of the family Oppiidae into subfamilies and genera.

<table>
<thead>
<tr>
<th>Oppiinae</th>
<th>Oppiellinae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multioppia Hammer</td>
<td>Oppia C. L. Koch</td>
</tr>
<tr>
<td>Oppiella Hammer</td>
<td>Oppiella Jacot</td>
</tr>
<tr>
<td>Aeroppia Hammer</td>
<td></td>
</tr>
</tbody>
</table>

Gittella Hammer

| Brachioppia Hammer       | Belloppia Hammer                 |
| Brachioppiella Hammer    | Chavinia Hammer                   |
|                         | Cryptoppia Csiszar                |
|                         | Cuneoppia Balogh et Mahunka      |
|                         | Enantioppia Balogh et Mahunka    |
|                         | Epimerella Kuliev                 |

| Globoppia Hammer         | Granuloppia Balogh               |
|                         | Karenpella Hammer                |
|                         | Laminoppia Hammer                |
|                         | Lanceoppia Hammer                |
|                         | Machuella Hammer                 |
|                         | Membranoppia Hammer              |
|                         | Oxyoppia Balogh et Mahunka       |
|                         | Porrhoppia Balogh                |
|                         | Quadroppia Jacot                 |
|                         | Sacculoppia Balogh et Machunka   |
|                         | Stachyoppia Balogh               |
|                         | Sternoppia Balogh et Machunka    |
|                         | Striatoppia Balogh               |
|                         | Teratoppia Balogh                |
|                         | Trapezoppia Balogh et Machunka   |
|                         | Trematoppia Balogh               |
|                         | Tripiloppia Hammer               |
|                         | Trizetes Berlese                 |
|                         | Tuberoppia Golosova              |

The acceptance of the notogaster setation of adult specimens as the main criterion of division of the family Oppiidae into subfamilies and genera is justified because:

- the presence or absence of setae ta and number of the remaining setae on the notogaster of adult specimens indicate a relationship between species,
- the new division permits the inclusion of juvenile forms in subfamilies,
- the criterion of setation is easier to interpret than the existing complex generic criteria, which do not eliminate subjective estimation and are based on many characters (sculpture, sensillus shape, arrangement of pores, shape and number of setae and so on).
ACKNOWLEDGEMENTS

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SUMMARY

The results of studies on the morphology of juvenile and adult forms of 16 species of moss-mites have suggested some new criteria of division of the family Oppiidae into subfamilies and genera. The criterion of division of the family Oppiidae into subfamilies is the absence (Oppiinae Grandjean) or presence (Oppiellinae nov. subfam.) of setae ta on the notogaster of adult individuals, while the subfamilies are divided into genera depending on the presence or absence of dorsal setae (da, dm and dp).

The new division supported by ontogenetic observations makes it possible also for juvenile forms to be classified to the appropriate subfamilies. The division is in line with the differences in walking behaviour: both the juvenile and adult individuals of the subfamily Oppiinae agitate the first pair of legs before putting them down, while members of the other subfamily walk without agitating their legs.

Instead of the 51 genera hitherto accepted, the new division of the family Oppiidae proposes only 4, grouped in two subfamilies.

REFERENCES


