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Variation in male genitalia of *Coleophora vacciniella* H.-S. (Lepidoptera, Coleophoridae)

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We studied 105 genitalia of mostly Finnish male *Coleophora vacciniella* Herrich-Schäffer, 1861, in order to inspect the variation in certain features: the number of chitinous teeth on the dorsal side of the phallotheca, the number of spines at the distal end of it, and the number of cornuti in the vesica. All of the parameters were close to a normal distribution, which did not coincide with our original idea of splitting this species complex into two or even more species. On the contrary, we had to synonymise *C. betulaenanae* Klimesh, 1958, with *C. vacciniella*, as we could not find reasonable differences between them.

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1. Introduction

Coleophora vacciniella H.-S. belongs to the grey-winged, case-bearing moths (Lepidoptera, Coleophoridae) which do not have thick scales in the first joint of the antenna (Group A in Hackman 1945). Toll (1962) classified this species to Section 12, which is characterised by phallotheca having spines at the distal end. According to literature, the larva lives on *Vaccinium myrtillus*, *V. vitis-idaea* and *V. uliginosum*, and it is exceptional in that it does not mine, but gnaws on the upper side of the leaves (Benander 1938, Hackman 1945, Toll 1962). Klimesch (1958) separated a new species from *C. vacciniella*, which he named *C. betulaenanae*. He found it in Austria living on *Betula nana*. This species has remained a little obscure since because it has only been reported in the Czech Republic (one male ex. l. 1993, J. Vavra leg.). For a while, *C. betulaenanae* was also included in the Finnish list, but later on it was excluded due to false determination (Hellén 1976). The given genitalia differences, especially pertaining to the male, seemed, however, to be good. Svensson (1993) accepted *C. betulaenanae* in the list of the lepidoptera calendar of Sweden.

Many years ago, together with the late Jorma Kyrki, we paid attention to the phenomenon that larvae resembling *C. vacciniella* also occurred on *B. nana* in Finland. In those days, we were not as skilful in the breeding of coleophorids, so the question remained open. Later on, we succeeded in breeding them and also found that these kinds of larval cases occurred on a variety of plants (Itämies & Tabell 1991). There was just one big 'but', the genitalia did not match that of *C. betulaenanae*,

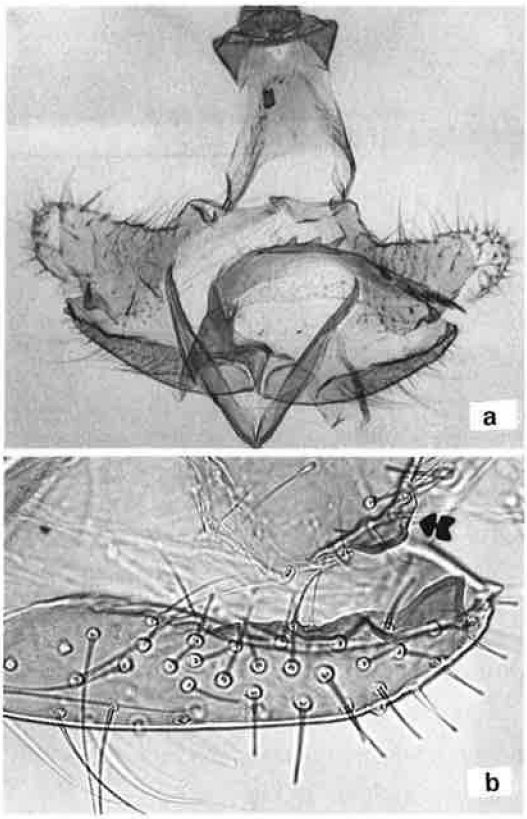

Fig. 1. Male genitalia of *Coleophora vacciniella* H.-S. (Lepidoptera, Coleophoridae). — a: General view. — b: A closer view around the tip of sacculus.

but *C. vacciniella*. This led us to inspect the complex in Finland more thoroughly.

The aim of this article is to give the results concerning the variation in the male genitalia morphology of mainly Finnish *Coleophora vacciniella*.

2. Material and methods

Moths, both imagos and larvae, were collected from different parts of Finland. Altogether, 105 genitalia slides were made and inspected regarding the following features. We counted the number of chitinous teeth on the dorsal side of the phallotheca, the number of spines at the distal end, and the number of cornuti in the vesica. Although especially the type of spines at the end of the phallotheca varied greatly, we did not divide them into any groups due to the continuing variation.

3. The general pattern of male genitalia in *Coleophora vacciniella*

The general outlook of the male genitalia is quite typical for a coleophorid (Fig. 1a): the valva is roundish and rather wide, the valvula is short and roundish, too. The sacculus is strongly chitinous and ends with two more-or-less clear extensions (Fig. 1b). In the corner close to the end of the sacculus, there is a characteristic fold (Fig. 1b; marked with an arrow!), which is only seen in *C. vacciniella* (see e.g. Toll 1962, Patzak 1974) and *C. canadensisella* McDunnough (see McDunnough 1955 (not visible in the figures of this article!)). The phallotheca (Fig. 2) (we have followed Razowski 1989 and 1990 in the terminology) is strongly chitinated from the upper side, while the limits of the under side are often hard to see in slides. The upper side of the phallotheca carries a varying number of strongly chitinated teeth (Fig. 2).

4. Results

The variation in the pattern of spines on the back of the phallotheca was great. The total number of spines varied from zero to five (Fig. 2). The size of the spines and their distance from each other varied especially. Among these six categories, the material was distributed quite normally (Fig. 3). When the material was grouped according to the food plant, no trends could be observed (Table 1). Instead, dividing the material into southern and northern samples showed a trend in the number of spines, i.e. in the southern area there seemed to be less spines, as compared with the northern ones (Table 2). However, even this difference was statistically non-significant (t-test: $t = 1.46$, $df = 100$, $p = 0.148$).

The number of spines at the end of the phallotheca and vesica were also distributed almost normally (Figs. 4 and 5), although the figure for the vesica spines is somewhat skewed. In addition, a faint indication of a bipartite curve in the distribution of spines at the distal end of the phallotheca can be seen. No correlation occurs between: a) the number of spines at the distal end of the phallotheca and the number of cornuti in the vesica ($y = 6.3697 - 0.110x$; $r = -0.0118$), and b) the number of spines on the back of the phallotheca

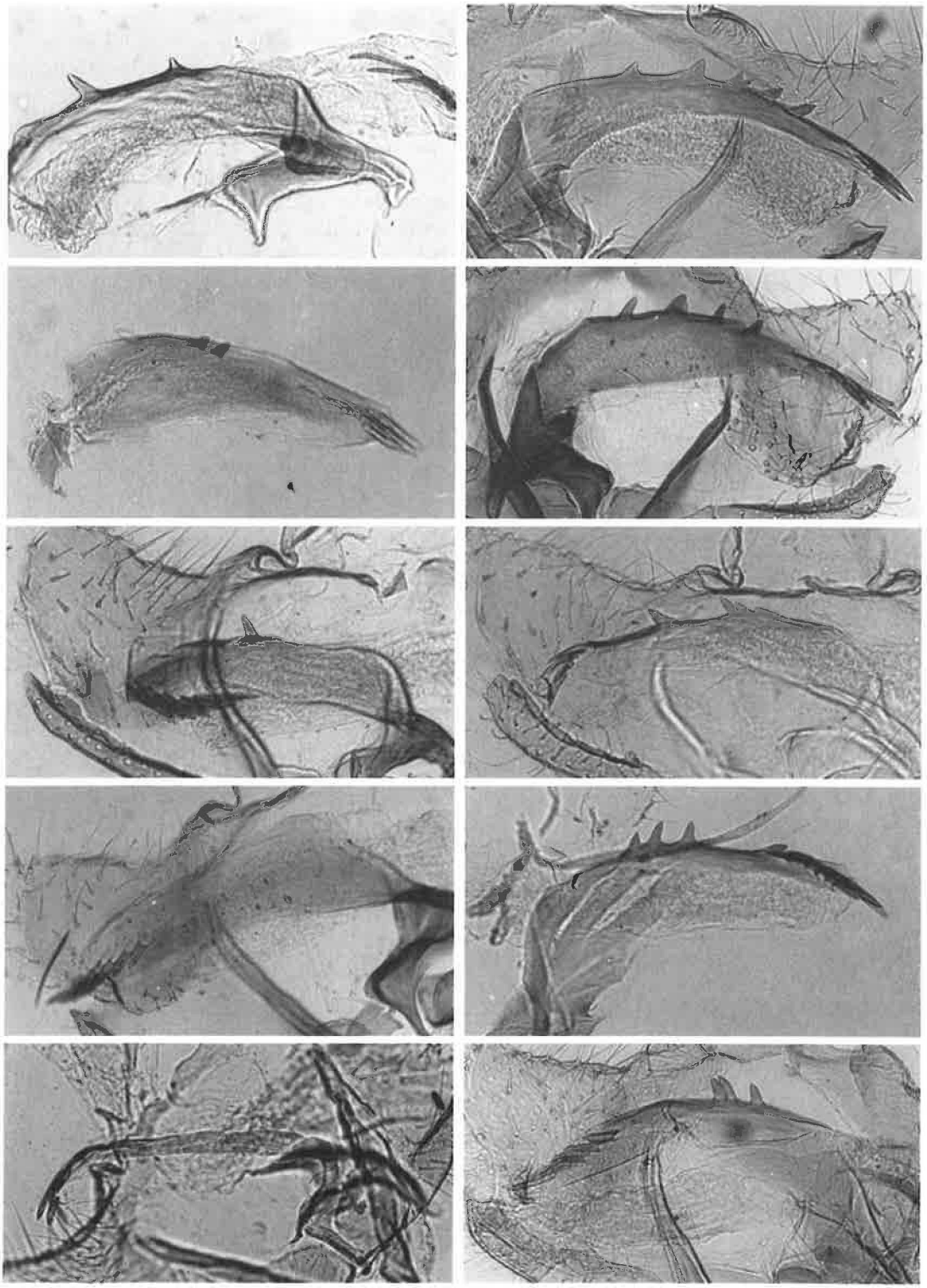

Fig. 2. Examples of the variation in the number of spines on the back of phallotheca of *Coleophora vacciniella*.

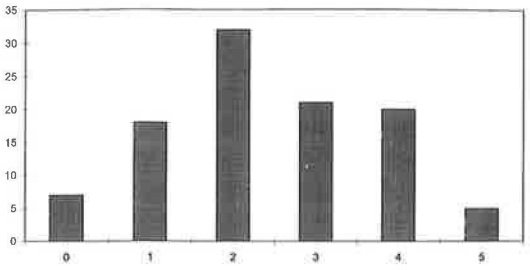

Fig. 3. Distribution of the number of spines on the back of phallotheca of *Coleophora vacciniella*.

and the number of cornuti in the vesica ($y = 6.6541 - 0.1478x$; $r = -0.0956$). Instead, a faint correlation was observed ($y = 6.0506 + 0.37599x$; $r = 0.22632$; $p = 0.024$) between the number of spines on the back and distal end of the phallotheca.

5. Discussion

The variation in the studied parameters in genitalia of Finnish *Coleophora vacciniella* was exceptionally large. If one were to take random specimens from both ends of the range, one could almost think them separate species! The variation seemed, however, to follow the normal distribution well enough, which does not support the idea of splitting *C. vacciniella* into two or more species, which was our original stimulus for studying the subject. Also, the fact that the distribution of different phallotheca types did not in any way follow the food plant, does not give reason to considering them different species. The observed difference in the emphasis of the distribution of spines on the back of phallotheca in northern and southern Finland, in our understanding, does not point to two species, but to a cline, which is typical, for instance, in the colour variation of many insects (see e.g. Halkka & Mikkola 1965, Kuusela *et al.* 1983). Toll (1962) has also made remarks on the variation of the number of teeth on the back of the phallotheca. According to Benander (1938), there are one or two teeth. Our material shows that, in Finland, there are from zero to five, and especially those with several teeth often have two or more points on the tooth itself. The second small increase in the distribution figure of the distal spines of the phallotheca (number of spines being 12–14) (Fig. 4), could be interpreted as showing the possibility of another less-abundant species. Because these specimens did not seem to have any common feature at all, it seems that there is no further basis for this view.

Kanerva (1941) paid attention to the colour variation of *C. vacciniella* and found some aberrant light-coloured females, which he named *f. pallescentella*. He, however, points out that he

Table 1. Distribution of the number of spines on the back of the phallotheca of *Coleophora vacciniella* in Finland, when grouped according to various food plants. Category "others" means those specimens collected freely.

	No. of spines of phallotheca					
	0	1	2	3	4	5
Food plant						
Betula pubescens	–	1	3	1	–	–
B. nana	–	1	1	1	1	–
Myrica gale	1	5	6	4	3	1
Rubus chamaemorus	–	2	–	2	3	–
Salix lapponum	–	1	–	–	–	–
Chamaedaphne calyculata	–	–	2	–	–	–
Vaccinium myrtillus	2	–	–	2	1	–
V. uliginosum	1	1	4	5	1	1
V. vitisidaea	–	–	2	–	–	1
Andromeda polifolia	–	–	–	1	1	–
Others	4	6	15	6	10	2

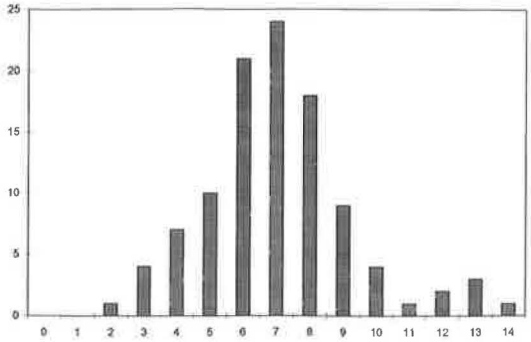

Fig. 4. Distribution of spines at the distal end of phallotheca of *Coleophora vacciniella*.

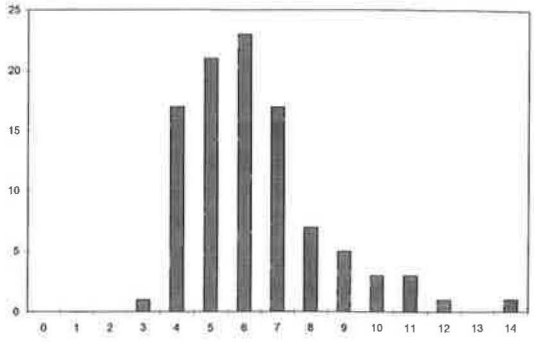

Fig. 5. Distribution of the cornuti of the vesica of *Coleophora vacciniella*.

could not find any differences in genitalia. We have not inspected the female genitalia so thoroughly, but so far we have not found any remarkable deviations from the basic scheme. Some variation is to be observed in them, too. When it comes to the colour of the forewings, it also varies in males from blackish grey to light grey with even a light brownish tint. Klimesch (1958) states the colour of *C. betulaenanae* to be dark ice-grey with blue–grey hairs.

The great amount of food plants observed earlier (Itämies & Tabell 1991) and also the differences in the way of feeding those plants (i.e. some larvae gnaw on the upper side of the leaf, some mine in a typical coleophorid way), makes one doubt, however, whether there could be more than one species. Also, the fact that the recorded plants are not so closely related to each other points to some possibility of a different species. It seems that *C. vacciniella* may represent a species complex where speciation is just in progress. So far, as we cannot separate them with reasonable features, we must keep them as ecological adaptions.

When Klimesch (1958) described *C. betulaenanae* as new to science, his most important diagnostic characteristics were that the phallotheca did not have any teeth on the dorsal side at all, and that the typical *C. vacciniella* fold on the corner at the end of the valva was missing. The former feature seems to represent one extreme in the variation that can be seen above. On the other hand, author JT has visited the area close to the original collecting place of *C. betulaenanae* in Austria and collected two cases, wherefrom one male was prepared, but it had teeth on the phallotheca! We have also examined the specimen from the Czech Republic and found it to be a typical *C. vacciniella* with one tooth on the phallotheca. The latter diagnostic feature, the fold, seems to be a misinterpretation, because even in the original slide (No. 1 422/Klimesch) it is visible, although not as well. We have also found some variation in the size of this fold, but we did not measure it in any way. In addition, no grounds exist for different living habits. However, it seems that all the diagnostic characters (food plant, living habits, habitus, genitalia) that Klimesch used do not separate *C. betulaenaneae* from *C. vacciniella*. This means that we cannot see any good reason for keeping *C. betulaenanae* as a good species, it must be synonymised with *C. vacciniella*, representing a junior synonym.

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Table 2. Distribution of the number of spines on the back of phallotheca of *Coleophora vacciniella* in Finland, when grouped according to geographical location.

	N of spines					
	0	1	2	3	4	5
N Finland	5	10	16	9	7	2
S Finland	2	7	19	13	9	3

References

Benander, P. 1938: Die Coleophoriden Schwedens. — Opuscula Entomol. 3: 30–110.

Hackman, W. 1945: Die Coleophoriden Finnlands. — Notulae Entomol. 25: 1–63.

Halkka, O. & Mikkola, K. 1965: Characterization of clines and isolates in a case of balanced polymorphism. — Hereditas 54: 140–148.

Hellén, W. 1976: Verzeichnis der in Jahren 1971–1975 für die Fauna Finnlands neuhinzugekommenen Insektenarten. — Notulae Entomol. 56: 109–120.

Itämies, J. & Tabell, J. 1991: Coleophora idaeella Hofmann, 1869 and C. vacciniella Herrich-Schäffer, 1861 (Lepidoptera, Coleophoridae): new records of food plants and biology. — Baptria 16: 47–50. (In Finnish with English summary.)

Kanerva, N. 1941: Mitteilungen über die Coleophoriden (Lep.) Finnlands. I–II. — Ann. Entomol. Fennici 7: 117–127.

Klimesch, J. 1958: Coleophora betulaenanae n. sp. (Lepidoptera, Coleophoridae). —Opuscula Zoologica 12: 1–4.

Kuusela, K., Itämies, J., Pyörnilä, A. & Pyörnilä, M. 1983: Geographical variation in the colour morphs of Cerapteryx graminis (Lepidoptera, Noctuidae) in Finland. — Notulae Entomologicae 63: 203–209.

McDunnough, J. H. 1955: New species of Coleophoridae, with notes on other species (Lepidoptera). — American Museum Novitates 1719: 1–7.

Razowski, J. 1989: Genitalia terminology in Coleophoridae. — Nota Lepid. 12: 192–197.

Razowski, J. 1990: Morphology of the intromittent organ and distal male genital duct in Coleophoridae (Lepidoptera, Gelechioidea). — Nota Lepid. 13: 221–228.

Svensson, I. 1993: Fjärilkalender Lepidoptera-calendar. — Österslöv. 124 pp.

Toll, S. 1962: Materialen zur Kenntniss der paläarktischen Arten der Familie Coleophoridae (Lepidoptera). — Acta Zool. Cracoviensia 7: 577–720.