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SILPHA BILINEATA REITTER, 1901 AND SILPHA TATRICA SMETANA, 1952 – NEW SYNONYMS OF SILPHA CARINATA HERBST, 1783, AND SOME ECOLOGICAL ASPECTS OF ITS INTRASPECIFIC VARIABILITY

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Key words: Taxonomy, synonymy, variability, ecology, zoogeography, vegetation period

Abstract

Silpha bilineata REITTER, 1901 and *Silpha tatriza* SMETANA, 1952 are synonymized with *Silpha carinata* HERBST, 1783. Consequently, the subgenus *Carpathosilpha* SMETANA, 1952 is synonymized with the genus *Silpha* LINNAEUS, 1758. The intraspecific variability and taxonomy of *S. carinata* is solved on the basis of ecological analysis of its variability. The validity of the subspecies *italica* KÜSTER, 1851 and *austriaca* OTTO, 1891 is confirmed. All other subspecific and infrasubspecific taxa subordinated to *S. carinata* are synonymized.

The species *Silpha bilineata* REITTER, 1901 and *Silpha tatriza* SMETANA, 1952 differ from other *Silpha* species by bicostate elytra being most similar to *Silpha carinata* HERBST, 1783 in all other characters. When studying extensive material of *S. carinata* I found two specimens having one elytra tricostrate and the other bicostate. From the above fact, as well as from the fact that *S. bilineata* and *S. tatriza* differ from each other much more than from some subspecific taxa of *S. carinata*, and from the fact that both bicostate species were not repeatedly observed during 80 or 30 years respectively, I found it necessary to verify their specific value. The considerable variability of *S. carinata* and its rather complex subspecific taxonomy, (contradicting in more aspects the modern taxonomy concept), were the reasons to solve this problem in a wider extent.

Material

Type specimens:
Silpha tatriza SMETANA, 1952. Mlynická dolina, VI. 1951, lgt. et coll. Smetana.

Silpha carinata var. *blattiformis* REITTER, 1901, Turkmenistan, coll. Mus. Nat. History, Budapest.

Silpha carinata var. *rufocincta* REITTER, 1901, Transbaikalia, coll. Mus. Nat. History, Budapest.

Silpha carinata race *croatica* OBENBERGER, 1922, coll. Nat. Museum, Praha.

Other material:

178 specimens of *Silpha carinata*, originating mostly from Slovakia and Moravia, coll. Slov. Nat. Museum, Bratislava; 254 specimens of *Silpha carinata* originating mostly from Carpathian Basin, Slovakia, Caucasus and Turkmenistan, coll. Mus. of Nat. History, Budapest.

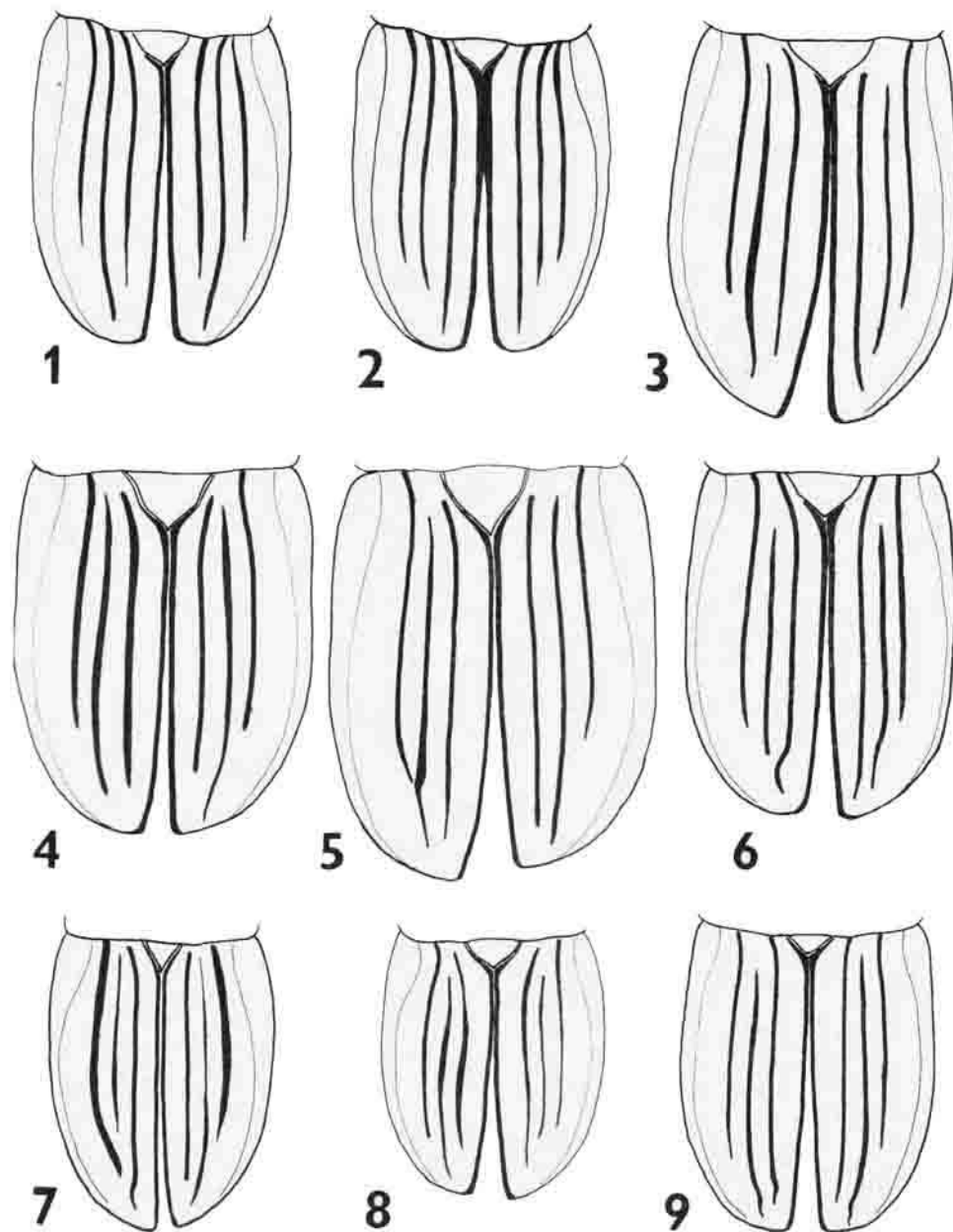
57 specimens of *Silpha carinata*, originating from all parts of Europe, coll. Moravské Museum, Brno.

369 specimens of *S. carinata* originating from Czechoslovakia, Ural, Finland, Siberia and Transbaikalia, coll. Nat. Mus., Praha.

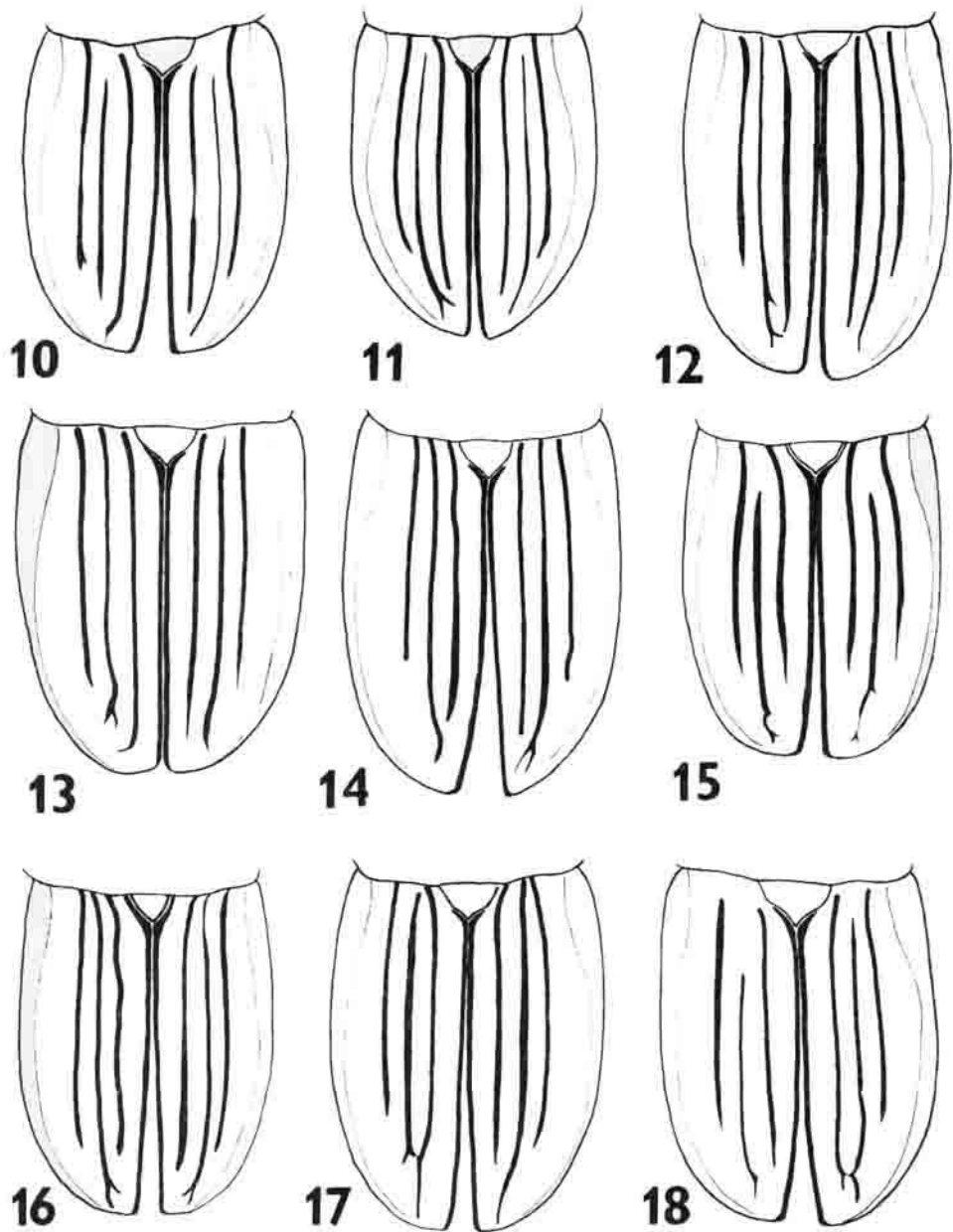
49 specimens of *Silpha carinata*, originating from Moravia, Caucasus and Turkmenistan, coll. author.

History

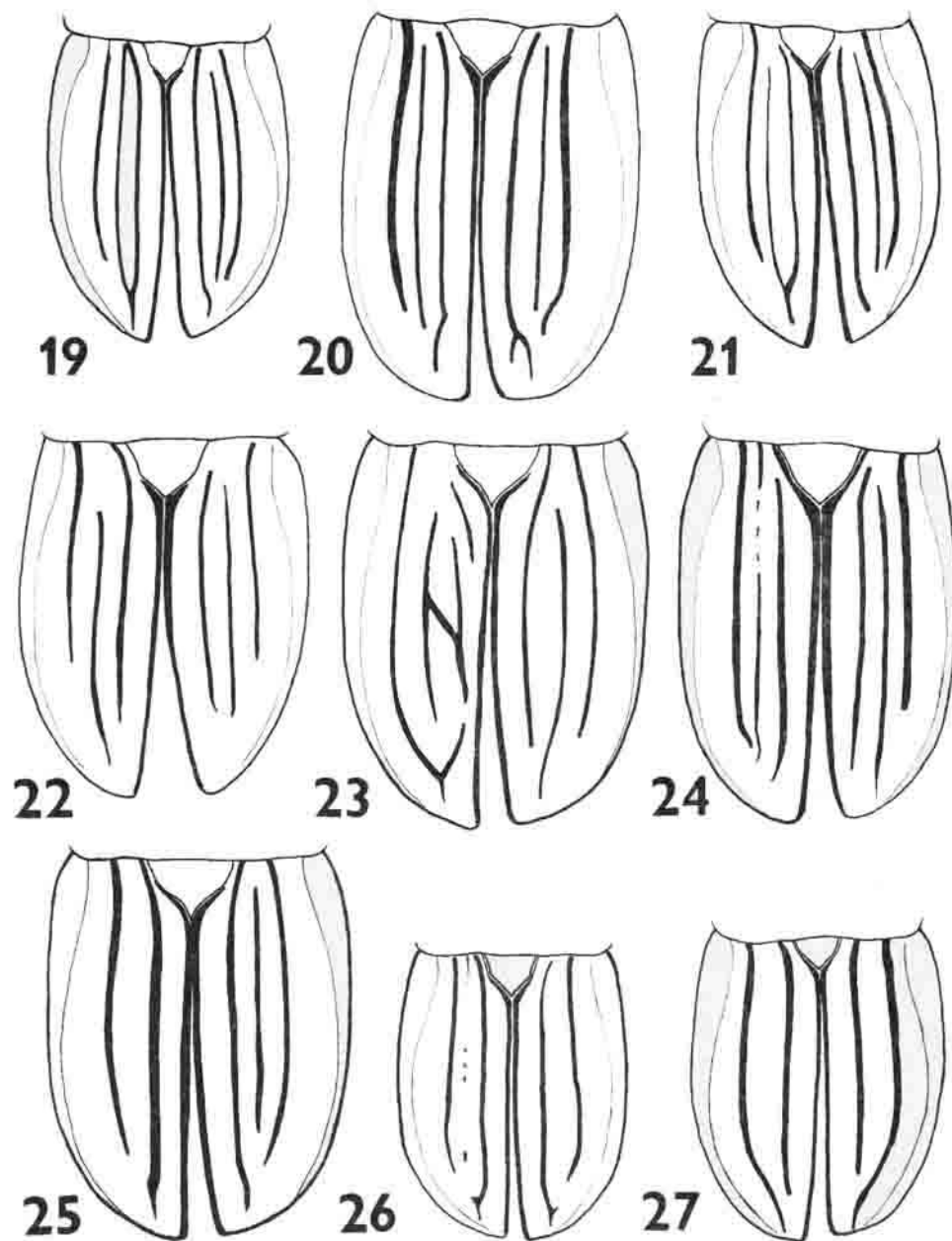
The extensive variability of the present species *S. carinata* was the reason why the earlier authors used to describe the aberrant individuals as separate species for several past centuries. Their relation and synonymy were explained as early as in the end of the first half of the past century, and the concept of a single species, viz. *S. carinata*, was accepted by all later authors. However, the tendency to distinguish the aberrant specimens of *S. carinata* into separate taxa was outliving during a long period until the year 1952. KOLENATI (1846, in GANDELBAUER, 1899) described the variety *armeniaca*, distributed in Caucasus, on the basis of slightly different shape of elytral costae. The large-sized individuals from North Italy were described as var. *italica* KÜSTER, 1851; the brown specimens from Russia were described as var. *atropurpurea* KÜSTER, 1851. The small, black shining individuals from the Alps were described by OTTO (1891) (in GANDELBAUER, 1899) as var. *austriaca*. REITTER (1901) described the little-sized brownish specimens from the Carpathians as var. *Carpathica* and the large black specimens from Turkmenistan as var. *blattiformis*. The large bicostate female from South Rumania was described as a separate species *S. bilineata* in the same paper (REITTER, 1901). The large, black female from Croatia was described as the race *croatica* OBENBERGER, 1922, and finally, a reddish individual from France was described as the "accident" *rufescens* PORTEVIN, 1926. SMETANA (1952) described one small, brown, bicostate male from the High Tatra as the separate species *tatrica* SMETANA, 1952. Smetana (1952) erected for this species and for REITTER's *S. bilineata* the subgenus *Carpathosilpha* SMETANA, 1952. The



Figs. 1-27. The form of elytral costae. Figs. 1-4 - *S. carinata carinata* from Moravia, Figs. 5-6 - *S. carinata* from Caucasus, Figs. 7-9 - *carinata austriaca* from the Alps, Figs. 10-19 - *S. carinata* var. *atropurpurea* from Ural and Siberia, Figs. 20-23 - *S. carinata* from Caucasus, Figs. 24-26 - *S. carinata* from Central Europe, Fig. 27. - *S. tatrica*, holotype, from High Tatra.



taxa mentioned were accepted in all revising works (REITTER, 1885; GANGLBAUER, 1899; PORTEVIN, 1926; MROCZKOWSKI, 1955; KRYZHANOVSKII, 1965; FREUDE, HARDE, LOHSE, 1973; PORTA, 1926; SZÉKESSY, 1961; CSIKI, 1909). The status of these subspecific taxa



fluctuated between aberration and variety in the earlier authors. The later authors (MROCZKOWSKI, 1955; SZÉKESSY, 1961) considered them as subspecies not to scatter their taxonomical validity.

When studying extensive material of *S. carinata*, it is possible to find many individual and asymmetrical deviations in the course of the three elytral costae. The most frequent deviation manifests itself in the length of individual costae. The external costa is, as a rule, the shortest of all. The middle costa is longer than the internal one in some specimens while the internal costa is longer than the middle one in other specimens. These two types of costae length relation may be symmetric (Figs. 1, 2) or asymmetric (Figs. 3, 4, 8). They occur in the same scale in all populations studied, independent of their origin. It is evident that the variety *armeniaca*, described on the basis of this character, represents only an example of occasional selection of two specimens, belonging to symmetrical individuals of these types in Caucasian and Middle European populations. As seen from Figs. 5 – 23, the individual costae may be furcated (Figs. 11 – 17), fused (Figs. 19, 21, 23, 25) or deformed in various mode. These deformations are usually asymmetric. The costae may be even interrupted and connected by a transverse branch of one costa (Fi. 23). As seen from the Figs. 19 – 21, the external costa tends to incline to the middle of elytra if the middle costa is shorter than the internal one. Also in this case this deviation may be symmetric or asymmetric. If the external costa is appropriate to the middle of elytra, it is obvious in some specimens that its apex is acutely declining in the direction of shorted middle costa and it occupies the place of it (Figs. 7, 27, 24, 20). This deviation is developed in different degree in individual specimens. Similarly, the internal costa takes the place of the middle costa (Figs. 10, 17, 25, 19). It is evident in both bicostate specimens of *S. carinata* that the asymmetrically developed central costa is reduced in its length (Fig. 25) or it is reduced only to the indistinct row of little tubercules (Figs. 24, 26). The external costa is declining towards the centre of elytra and there it is acutely declining in the direction of reduced or absent central costa (Figs. 25 – 27). In *S. tatrica* is the middle costa indicated by a short process on the base of left elytra (Fig. 27). It is also seen in both asymmetrical bicostate specimens that the external costa is more appropriate to the internal one than in the normal specimens. It is obvious in *S. tatrica*, too. It is evident from the mode of course of external costa in the devious specimens that it takes partly a role of the central costa on the bicostate specimens. The string of successively developing deviation of costae (from those having little reduced length of central costa to those with only two costae – the external and internal), the fully occasional mode of coste furcation and their asymmetric transversal connection, as seen in the Figs. 1 – 27, force one to consider the number and shape of elytral costae in *S. carinata* to be insignificant for distinguishing of the individual subspecific taxa and for stabilizing a good species. The trend towards reduction of costae may be considered as a slight evolution or tendency common to the whole subfamily *Silphinae*. We may see its extre-



Fig. 28. The distributional areas of individual subspecies of *S. carinata* according to the literature. A – *ssp. carinata*, B – *ssp. carpathica*, C – *ssp. austriaca*, D – *ssp. italica*, E – *ssp. croatica*, F – *ssp. atropurpurea*, G – *ssp. armeniaca*, H – *ssp. biattiiformis*, CH – *ssp. rufocincta*, I – *ab. rufescens*.

me existing form in the genus *Ablattaria* or in the Carpathian endemic species *Silpha oblonga*, in which the reduction is genetically fixed. In all mentioned species the slight indication of all costae (*Ablattaria* spp.), or of central or internal costa in *S. oblonga*, appears to be an atavism occasionally visible in some individuals. The reduction of costae in *S. carinata* is to be observed as a kind of inverse form of such atavism basing no description of a new taxa.

The variability of colour and size in *S. carinata*

As seen from the diagnoses of the subspecific taxa subordinated to *S. carinata* (REITTER, 1901; GANGELBAUER, 1899; OBENBERGER, 1922 in PORTEVIN, 1926), the colour is often used as a distinguishing characteristic. When comparing the presence of red or black colour in the individual taxa, we may conclude that the red, reddish or brown colour is, according to the descriptions (GANGELBAUER, 1899; REITTER, 1901; OBENBERGER, 1922; and SMETANA, 1952), common to the taxa distributed in the mountains (the Carpathians and the Alps) and in the territories with hard winters in the north-east part of the distributional area of *S. carinata* (Russia, Siberia). The black colour is common to the taxa from relatively warm climate in southern parts of the distributional area (Italy, Balkan, Turkmenistan, Middle Europe) and in lowlands in North Europe (Finland). (Fig. 28). It is evident that the colour of *S. carinata* is influenced by the climate. If we should use the altitude as a criterion, we would find the high

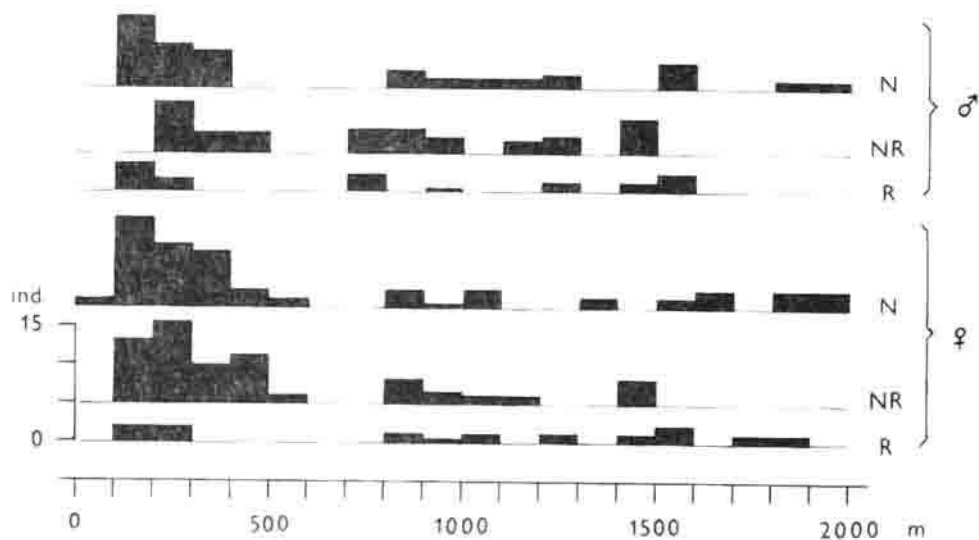


Fig. 29. Number of black (N), brown-black (NR) and brown (R) individuals of *S. carinata* in the dependence on altitude. Only precisely located specimens have been evaluated

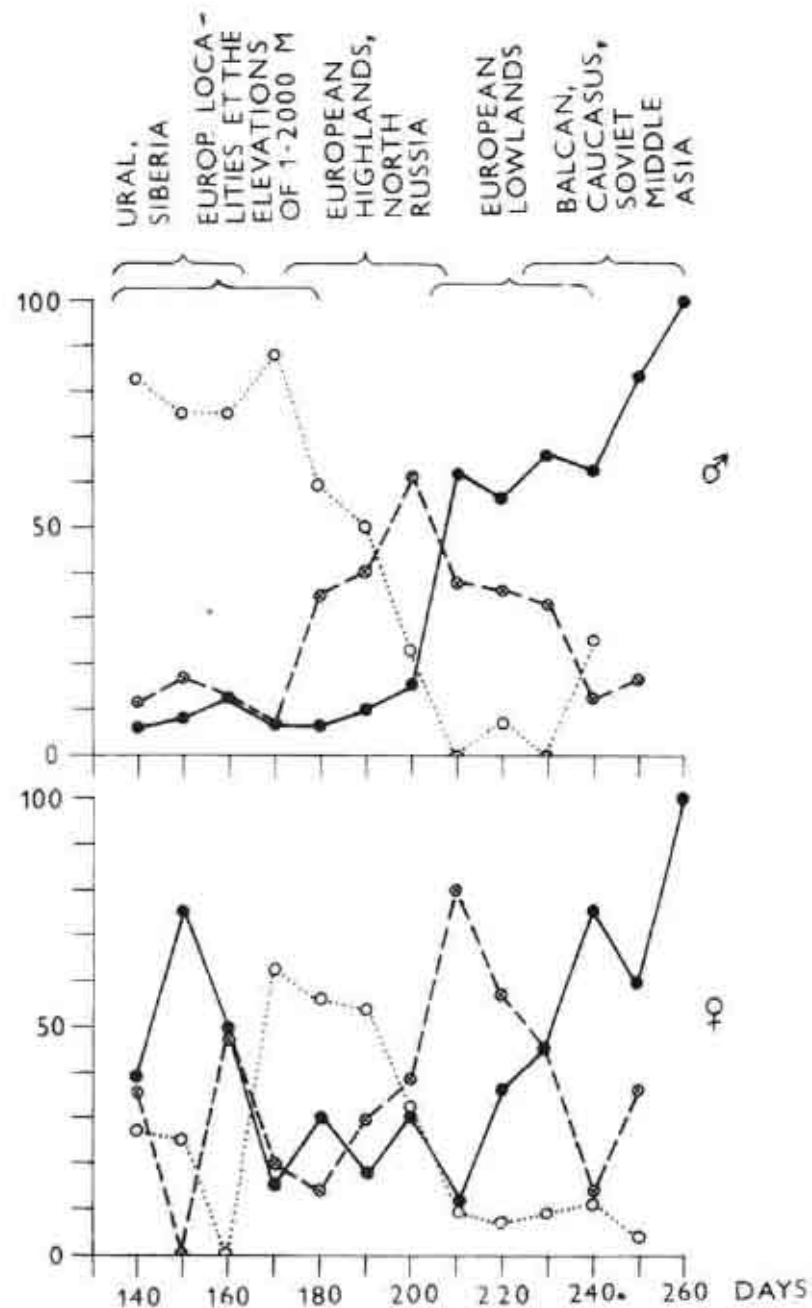


Fig. 30. Percentual representation of brown (pointed), brown-black (dashed) and black (fully) in the dependence upon the length of vegetation period (in days)

degree of correlation between colour and altitude only in a limited territory (Fig. 29). If we should examine the material originating from the large territory, we would find some contradictions, e. g. the black-coloured specimens of South Finland in relatively high altitude; the big, black-coloured specimens of the altitude of 1000–1500 m in Caucasus on the one hand, the reddish brown and small specimens of the altitude 1300–1500 m in the Tatra mountains; the reddish brown specimens from lowlands in southern margin of Ural etc., on the other hand. When studying concrete material of *S. carinata* from the total distributional area, we may find that the colour is not fixed in any taxa given in the literature. In the whole area we may order successive ranks from red or brown specimens to black-coloured individuals. When analysing this phenomenon and the above facts precisely, we find a positive relation between the colour and the length of the vegetation period (the days of the average temperature higher than 5 °C), (Figs. 30–32). As seen from the Fig. 30, the red or brown specimens are frequent or occurring exclusively in the territories of 140–180 days of vegetation period. The intermediate brown-black specimens occur in the territories of about 200 days of vegetation period and the black individuals in the territories of about 220–260 days of vegetation period. In the territories of 250 days or longer period (Hungary, Yugoslavia, Caucasus, Italy) we find only black specimens. This rule has no exception in the whole material studied. An analogical influence of the length of the vegetation period is visible also in the body size (Figs. 31–32). The small specimens in the size of 12–15 mm occur in the localities under 140–190 days of vegetation period, the intermediate individuals in the size of 15–20 mm occur under 190–240 days of vegetation period and the largest specimens (20–22 mm) occur in the territories with 240–260 days of vegetation period. The laws of these relations described above are well distinct in both sexes. They are also evident from the high degree of correlation between the body length and the frequencies of the individual colour degrees (Figs. 31, 32, 33). As seen from these figures, the small specimens are incomparably more frequently brown than black. The number of brown specimens decreases with the growth of the body length. The giant specimens are always black. This phenomenon is well visible in both sexes and in the specimens originating from the whole distributional area of *S. carinata*. The linear dependence of the body length on the altitude in the small territory of the Carpathians is visible from Fig. 29. The declining body length is of fluent character in the direction from the lowland specimens up to specimens of montane elevations. No gap in body length permitting to distinguish two subspecies on the basis of these characters can be observed, which fact contradicts indications formed in the literature (REITTER, 1901).

One generation life cycle of *S. carinata* when put into the context with the above facts offers, under various length of vegetation period, rather different conditions for the development of the same species. This must affect its habitus and size like in other insects. If the ecological tolerance

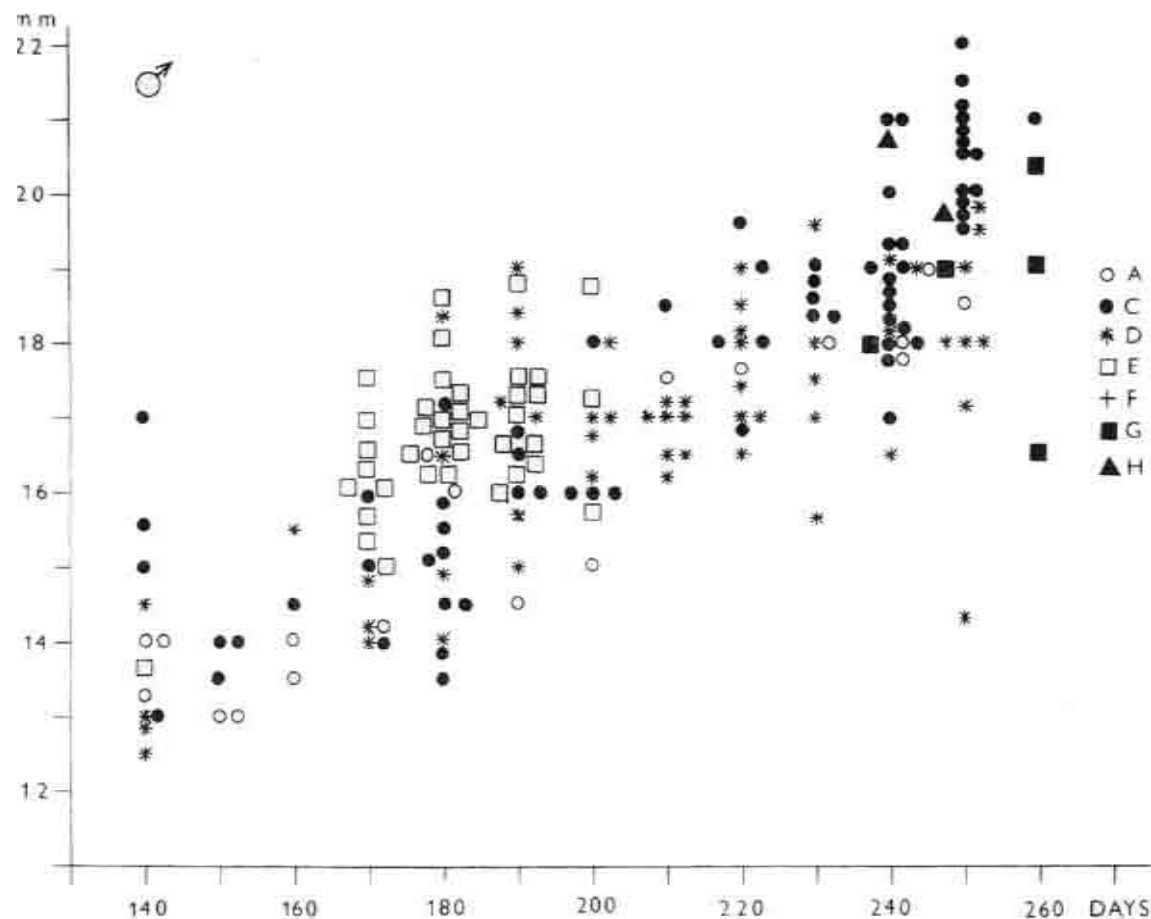


Fig. 31. Correlation of body length and colour in the males of *S. carinata* and of the length of vegetation period. A – brown, B – black and C – brown-black individuals from Central Europe; D – brown, E – brown-black and F – black individuals from Russia, Siberia and Transbaikalia; G – black individuals from Caucasus, otherwise coloured specimens were absent in the Caucasian material

of *S. carinata* permits this species to finish its life cycle under 140–180 days of vegetation period on the one hand, the more favourable conditions of 240–260 days of vegetation period lead to a development of giant individuals, on the other hand. If, on the contrary, the vegetation period of 240–260 days is prerequisites for finishing the life cycle, it must be expected that much shorter vegetation period should induce some changes in the habitus and body size, such as in so-called “hungry forms” in *Lucanus cervus* or in other insects.

The black colour prevails in all related species, being formed only in a portion of individuals of the montane species *Silpha tyrolensis* and *Sil-*

pha oblonga. The other species of the genus *Silpha* are exclusively black. Considering this fact, the little body size and brown colour (or a trend to brown) represent a common reaction of *S. carinata* and related species upon the insufficient nutrition, low temperatures, and short vegetation period due to high altitude, high latitude and to the high degree of continentality of the climate. We may conclude, on the basis of the existence of successive intermediate specimens, that the differences described above are taxonomically insignificant and that they presumably occur everywhere the length of vegetative period is shorter than 190 days. This fact was obvious even when considering that the present study was carried out on the basis of museum, often inexactly located, material. The heuristic value of this material was lower due to the collectors' preference of extremely cold montane habitats, on the one hand, and of warm habitats in lowlands, on the other.

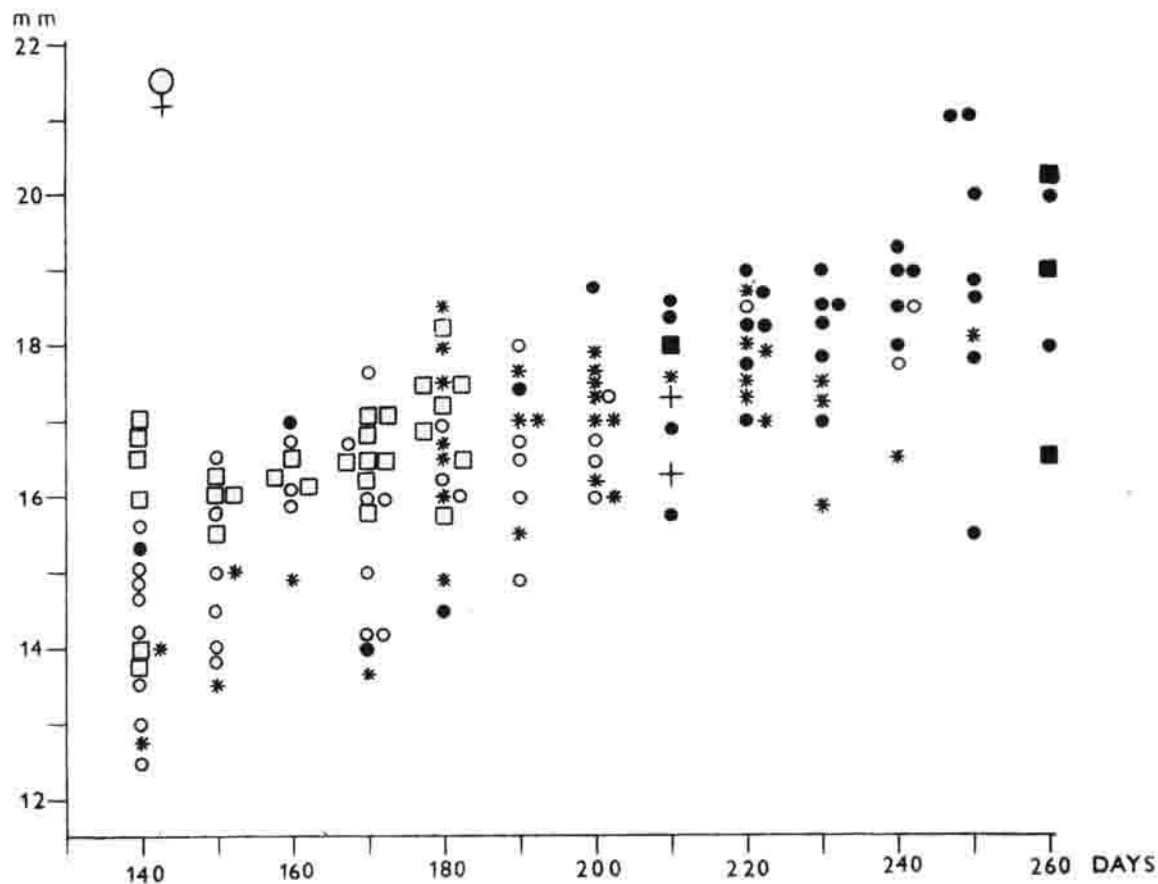


Fig. 32. Correlation of body length and colour in the females of *S. carinata* and of the length of vegetation period, abbreviations and symbols as in Fig. 31

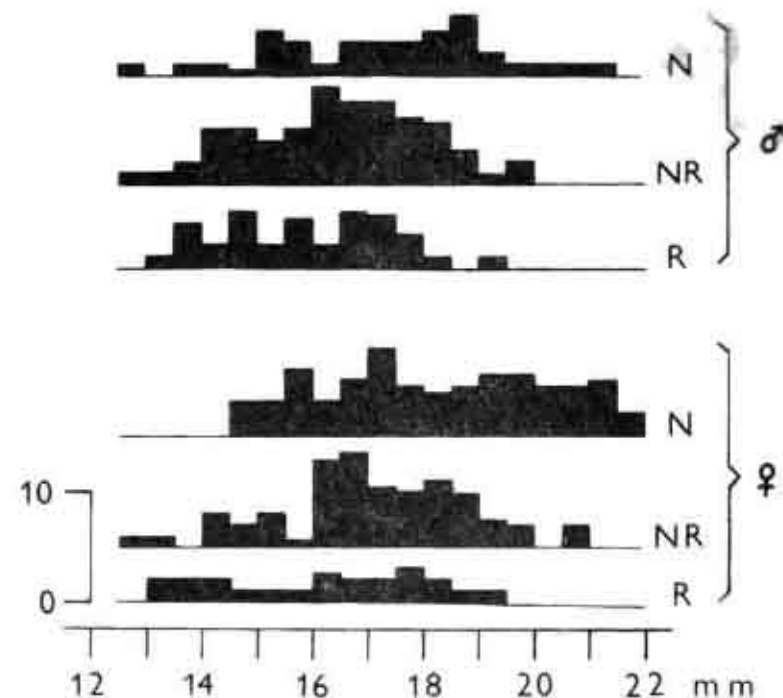


Fig. 33. Relation between body length and colouration in *S. carinata* from Czechoslovakia, N — black, NR — brown-black, R — brown

The interesting, until further notice purely hypothetical factor evocating the development of brown-black individuals represents the imision pollution. The reason for this conjecture is the large number of relatively small, brown-black individuals of *S. carinata* occurring in the heavy polluted eastern parts of Bratislava and contradicting in their colour and size the older museum material originating from this territory.

The body shape variability of *S. carinata* and subordered taxa

The body shape was used to separate individual taxa (REITTER, 1901; OBENBERGER, 1922 in PORTEVIN, 1926; PORTEVIN, 1926). Generally, the shape in the ssp. *austriaca* and ssp. *carpathica* is, according to the literature, narrower than in ssp. *carinata*, ssp. *croatica*, ssp. *blattiformis*, ssp. *italica*, ssp. *atropurpurea*, ssp. *rufocincta* and ab. *rufescens*. The narrower pronotum is characteristic of extremely small montane specimens, and a wider pronotum is characteristic of other forms (Figs. 35, 36). The intermediate individuals, however, are very frequent and they represent the majority of the individuals. More rounded body sides appear to be characteristic especially of ssp. *italica*, the parallel-sided body is according to REITTER (1901) characteristic of ssp. *blattiformis*.

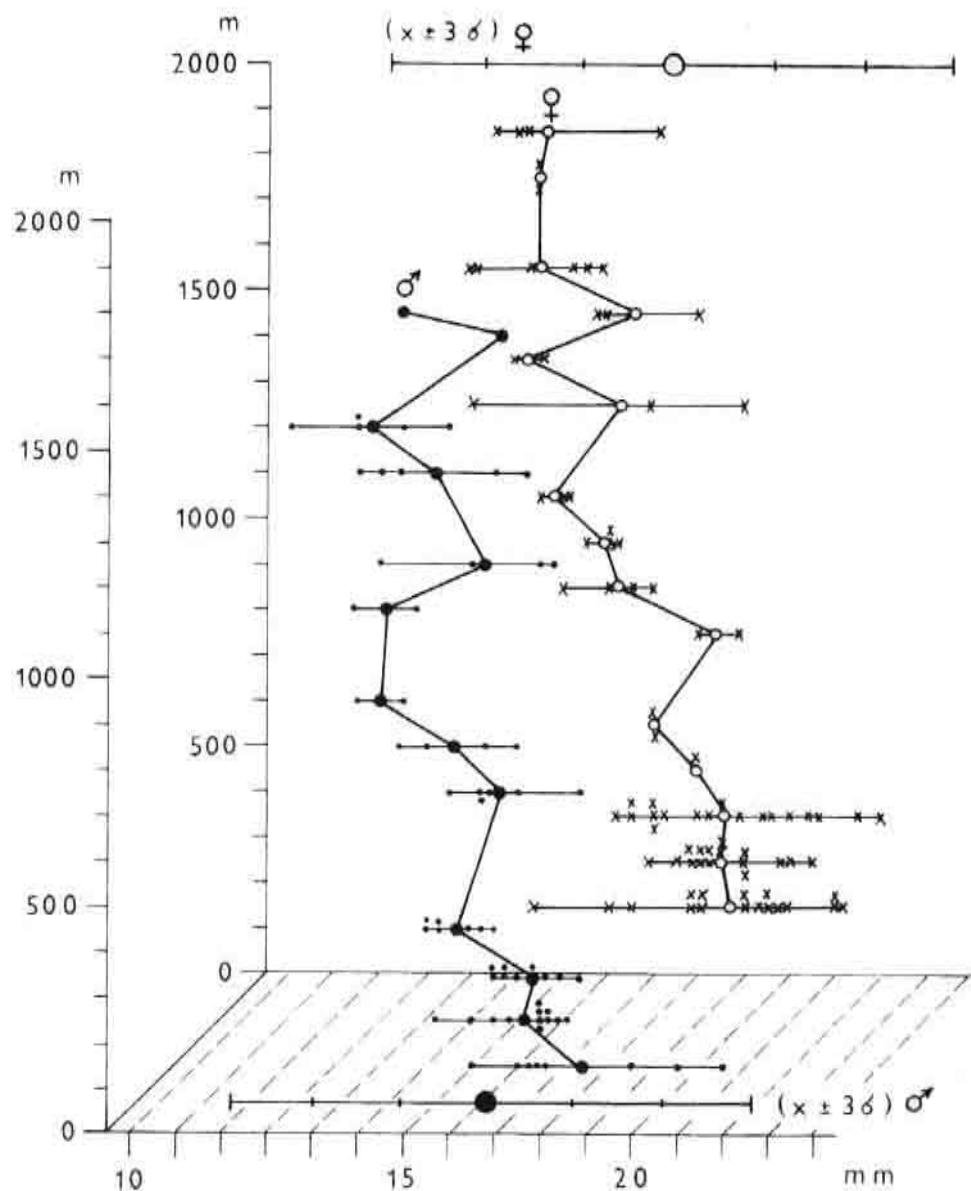


Fig. 34. Relation between body length in *S. carinata* from Czechoslovakia and altitude. \bar{x} - mean length, σ - standard error

As seen from Figs. 35 and 36, the relation of body length and of elytrae width, as well as the relation of pronotum length and width, make it impossible to discern groups of populations corresponding to individual subspecific taxa mentioned above and to their characteristics in the literature.

The dispersals of their variability overlap. The separation of individual specimen groups corresponding to any of these subspecies is possible only in extreme specimens and in limited material.

Similarly, the shining of body used for separation of *ssp. austriaca* from *ssp. carpathica* and *ssp. atropurpurea* represents a very inconstant character. Its instability is so large that it leads to confusions in the identification. So, according to ROUBAL (1930), the subspecies *austriaca* should occur in the Low Tatra, consequently in the centre of the distributional area of *ssp. carpathica*. A considerable amount of intermediate specimens exists in both subspecies as a matter of fact. The only character common to the montane subspecies *italica*, *ssp. austriaca* and *ssp. carpathica*, and separating these subspecies reliably from the other populations of *S. carinata*,

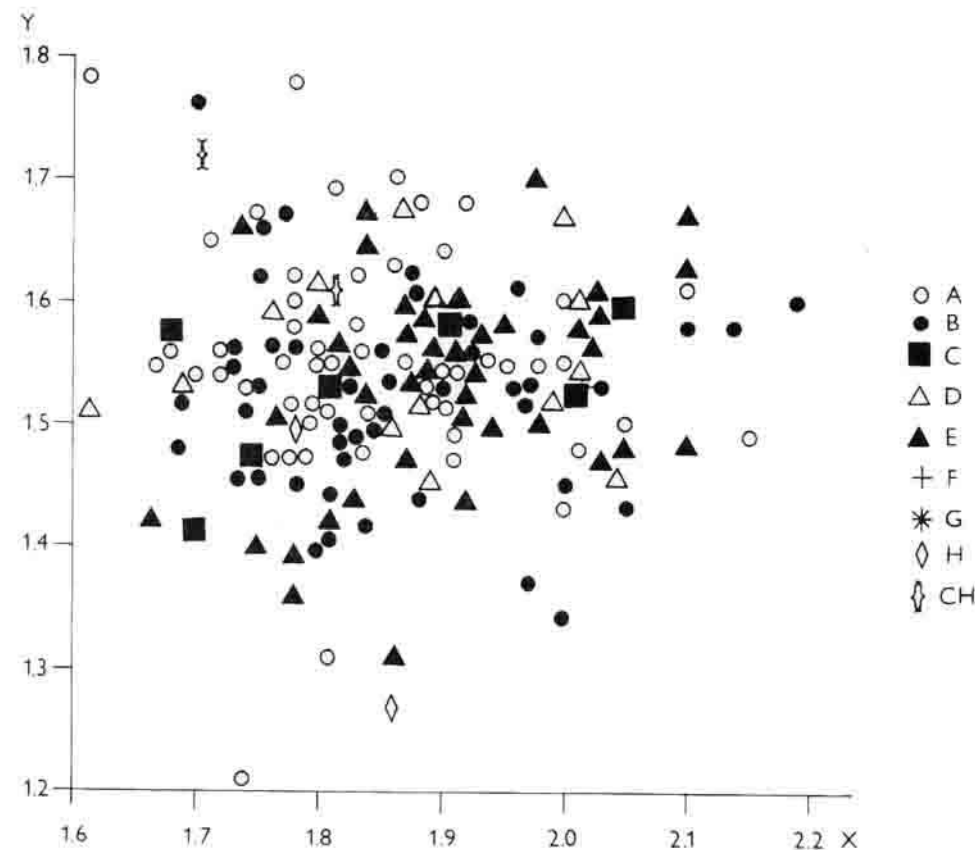


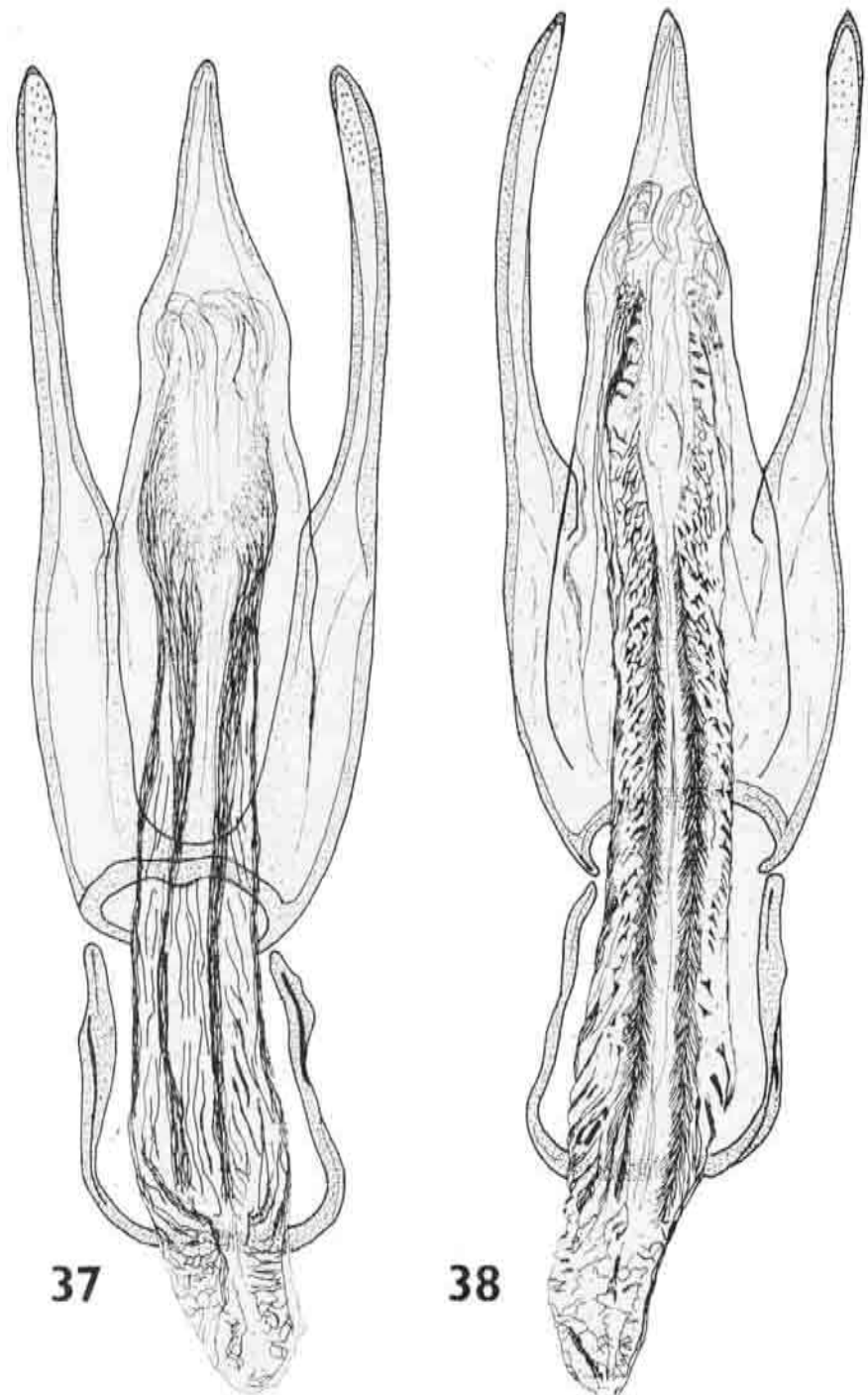
Fig. 35. Dispersal of the ratio of pronotum length and width (Y) and of the ratio of body length and elytrae width (X) in males of *S. carinata* from individual parts of its distributional area. A - European lowlands, B - the Carpathians, C - the Alps and Sudets, D - Caucasus, E - North Russia, Siberia, F - Turkmenistan, G - Kasakhstan, H - South Finland, CH - Italy

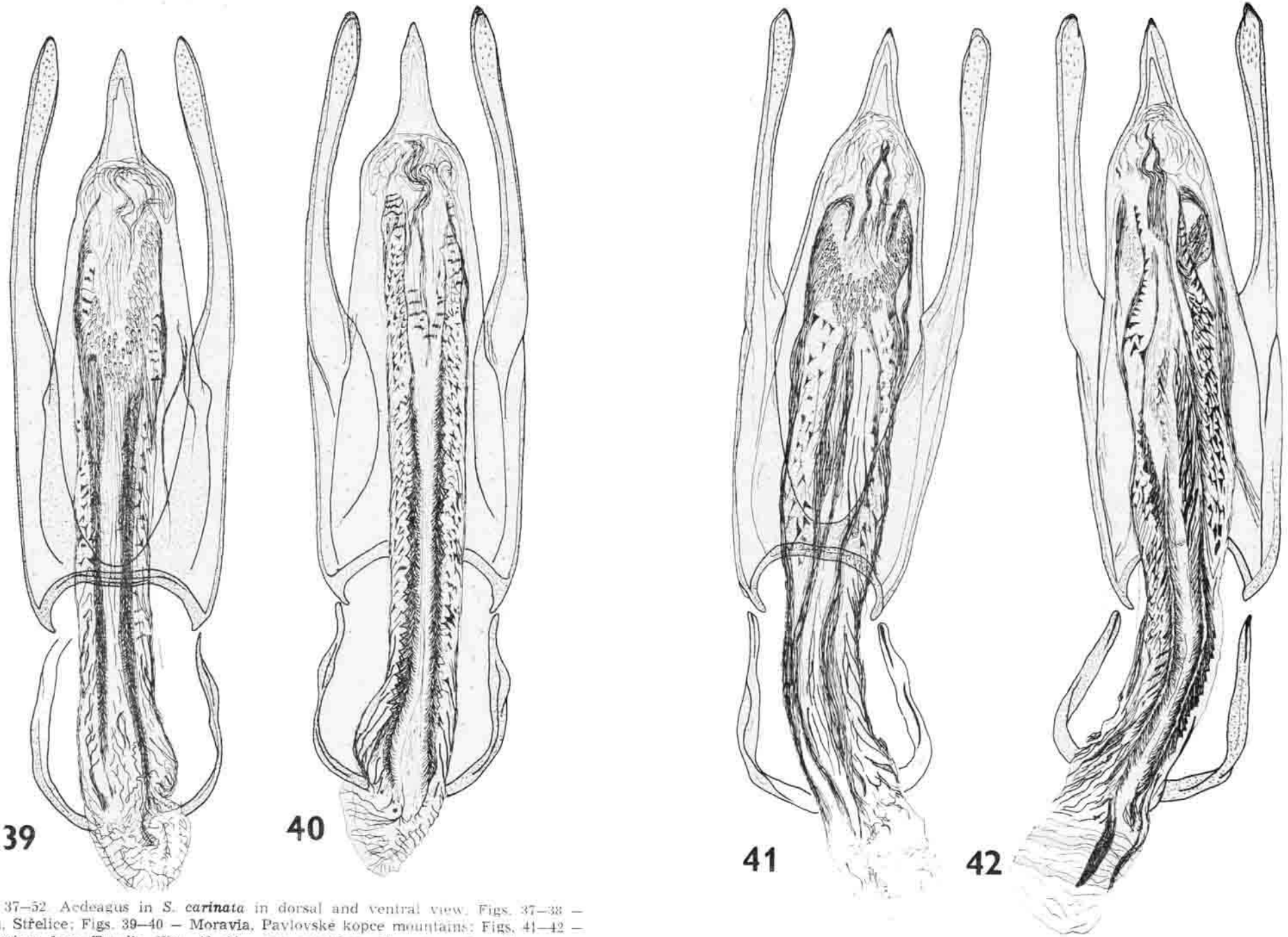
territories (compare Figs. 37 and 38 with 38 and 40: all from South Moravia, ssp. *carinata*; Figs. 45 and 46 from Ural and Figs. 47 and 48 from Kuban, South Russia with Figs. 49 and 50 from Kuban; ssp. *atropurpurea*; Figs. 41 and 42 from Tyrolia with Figs. 43 and 44 from Jeseníky mountains, ssp. *austriaca*). No morphological difference in form is visible between the Figs. 41 and 50 (*S. carinata*), Figs. 51 and 52 (asymmetrically bicostate *S. carinata*) and Figs. 53 and 54 (*S. tatrica*). Analogical little shape differences are visible in the terminal lamella of the internal sac (Figs. 57 – 62) and in the number and shape of arrow-formed lamellae on the lateral side of median part of the internal sac (Figs. 37 – 54). They also vary in the individuals originating from the same territory (Figs. 57 and 58 from Moravia, Figs. 61, 63 and 64 from South Russia, 59 from Tyrolia and 60 from Jeseníky mountains). No difference is visible between *S. carinata* (Figs. 37 – 52 and 57 – 64) and *S. tatrica* (Figs. 53, 54 and 65). The differences in the form of arrow-shaped lamellae are due to membranous character of internal sac and its frequent deformations as shown in Figs. 67 and 68. Their various forms in the Figs. 37 – 54 are due to their various position in the aedeagus, various degree of overlapping (Figs. 69, 70) and various projections when drawing. The shape of arrow- and needle-formed lamellae is identical in the individuals from Ural and South Moravia (Figs. 69 – 70) theoretically belonging to two different subspecific taxa, viz. ssp. *carinata* and ssp. *atropurpurea*. It is to conclude from the facts above that the described little differences in the shape of aedeagus are insignificant for the separation of specific or subspecific taxa from *S. carinata*. These differences are not correlated in any kind with the tri- or bicostation of elytrae. Their insignificance gets very striking in the contrast to aedeagi of the related species, viz. *S. oblonga* and *S. obscura*, (Figs. 55 and 56) and to their micro-anatomical characters (Figs. 62 and 66).

Discussion

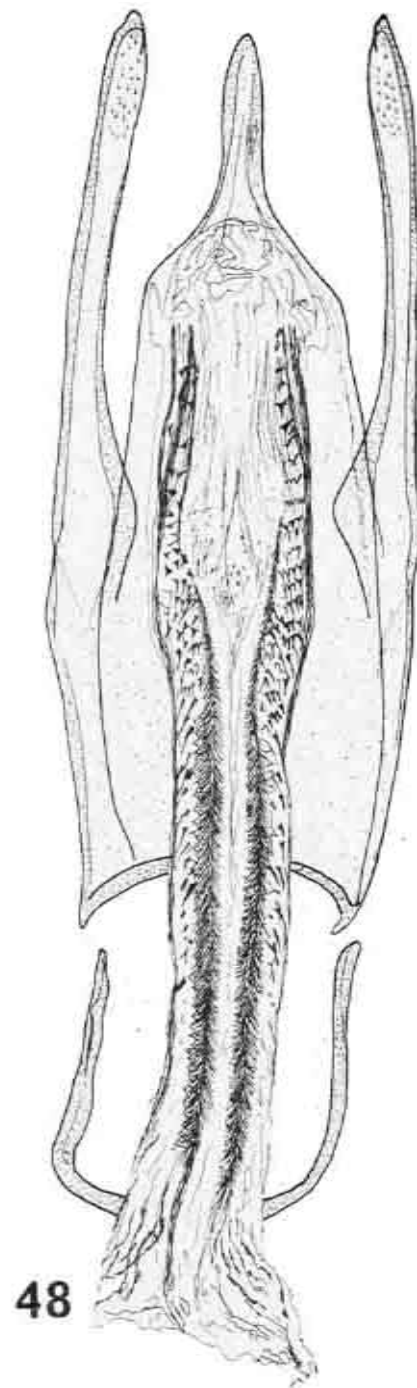
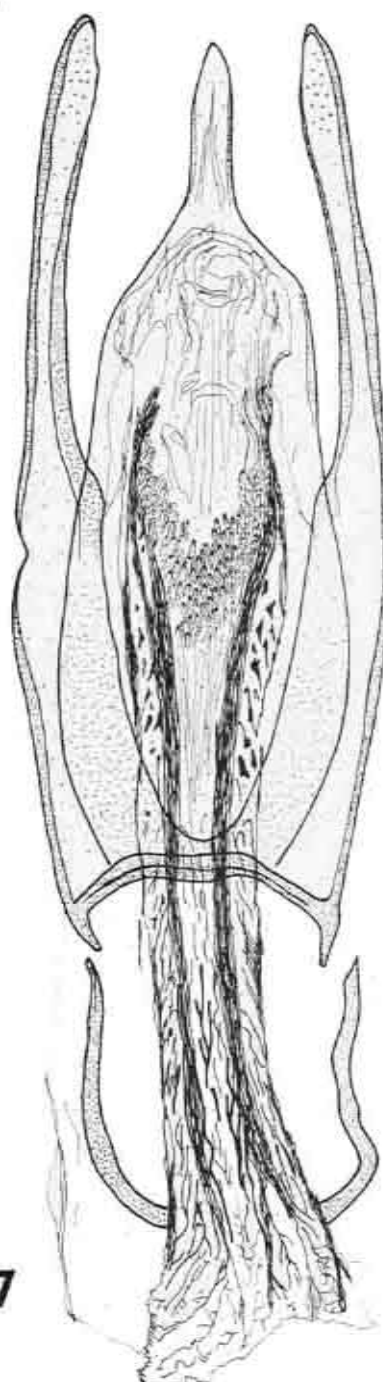
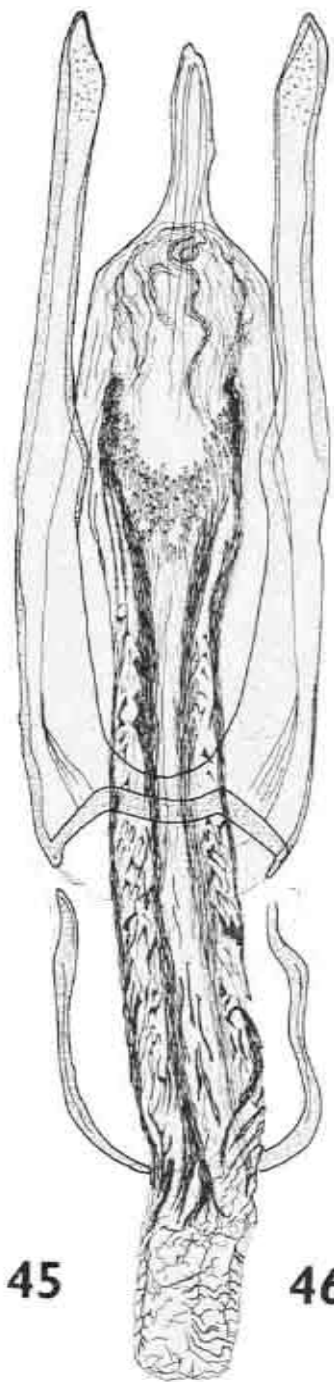
The ecological character of colour and size variability in *S. carinata*, the occasional character of number and form of elytral costae, and the study of extensive material of 907 individuals show that *S. carinata*, *S. bilineata* and *S. tatrica* represent a single taxon, viz. *S. carinata*. Because of their identity the subgenus *Carpathosilpha* is synonymous with genus *Silpha*.

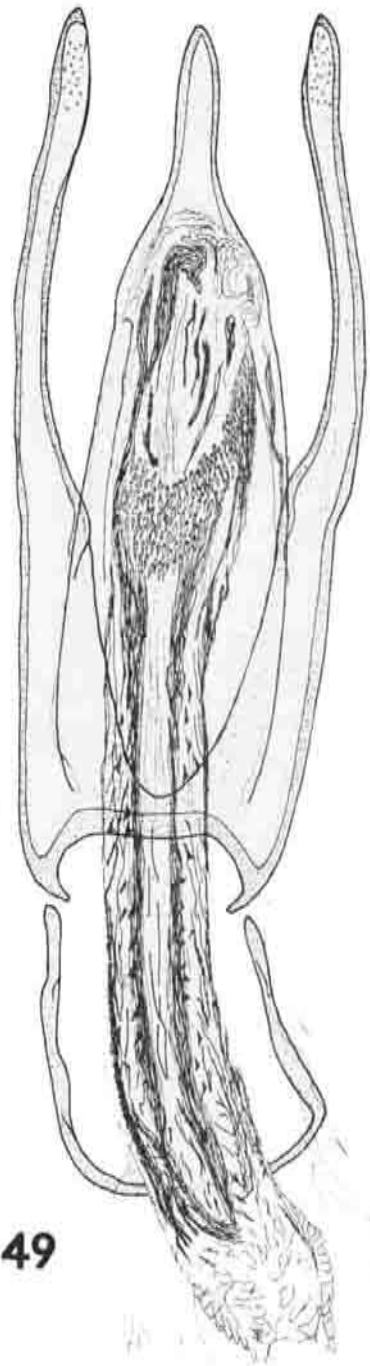
In the frame of subspecific and infrasubspecific taxa subordinated to *S. carinata*, viz. var. *armeniaca* KOLENATI, 1846; var. (or ssp. auct.) *italica* KÜSTER, 1851; var. (or ssp. auct.) *austriaca* OTTO, 1891; var. (or ssp. auct.) *blattiformis* REITTER, 1901; ab. (or var. or ssp. auct.) *atropurpurea* KÜSTER, 1851; var. (or ssp. or ab. auct.) *rufocincta* REITTER, 1901; var. (or ssp. auct.) *carpathica* REITTER, 1901; race (or ssp. auct.) *croatica* OBENBERGER, 1922; ab. *rufescences* PORTEVIN, 1926; the taxon *armeniaca* represents an occasional monstrosity being synonymous with *S. carinata*. The taxa *blattiformis*, *croatica*, *atropurpurea*, *rufocincta* and *rufes-*



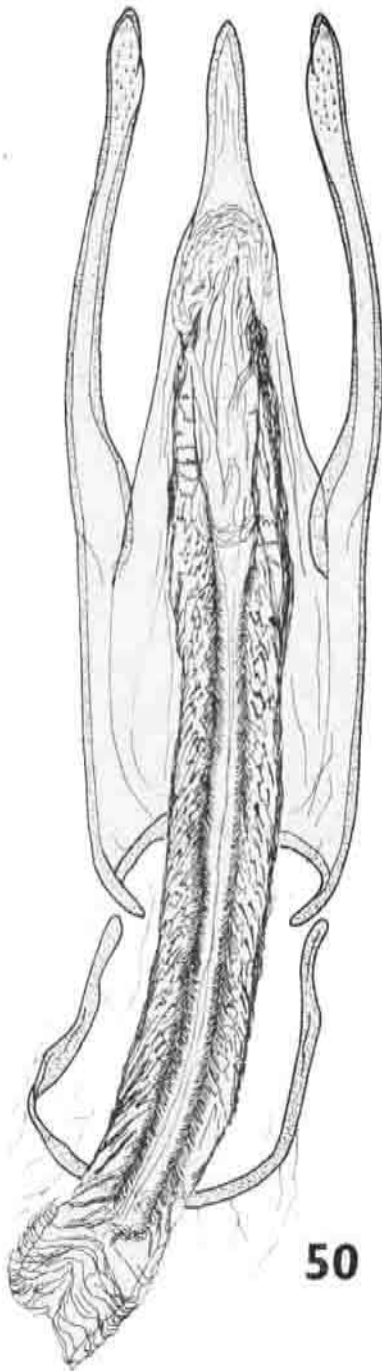


Figs. 37-52 Aedeagus in *S. carinata* in dorsal and ventral view. Figs. 37-38 - Moravia, Střelice; Figs. 39-40 - Moravia, Pavlovské kopce mountains; Figs. 41-42 - ssp. *austriaca* from Tyrolia; Figs. 43-44 - ssp. *austriaca*, Moravia - Jeseníky mountains; Figs. 45-46 - ssp. *atropurpurea*, Ural; Figs. 47-48 - ssp. *atropurpurea*, Kuban, Russia; Figs. 51-52 - asymmetrically bicostate *S. carinata* from Moravia

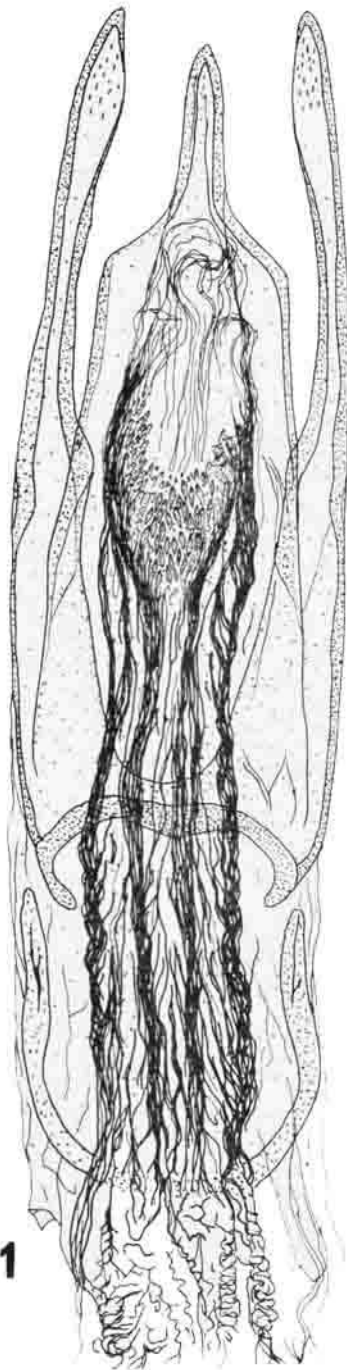




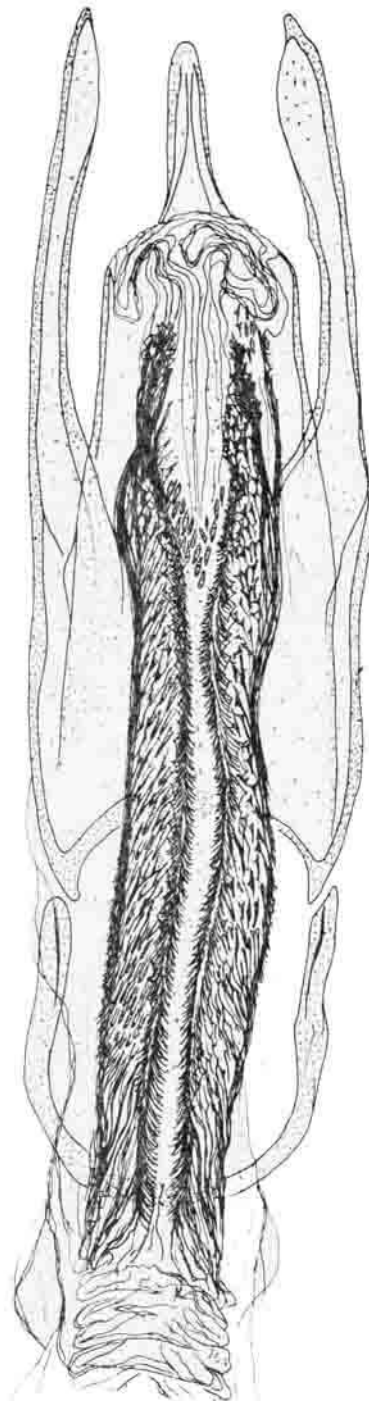
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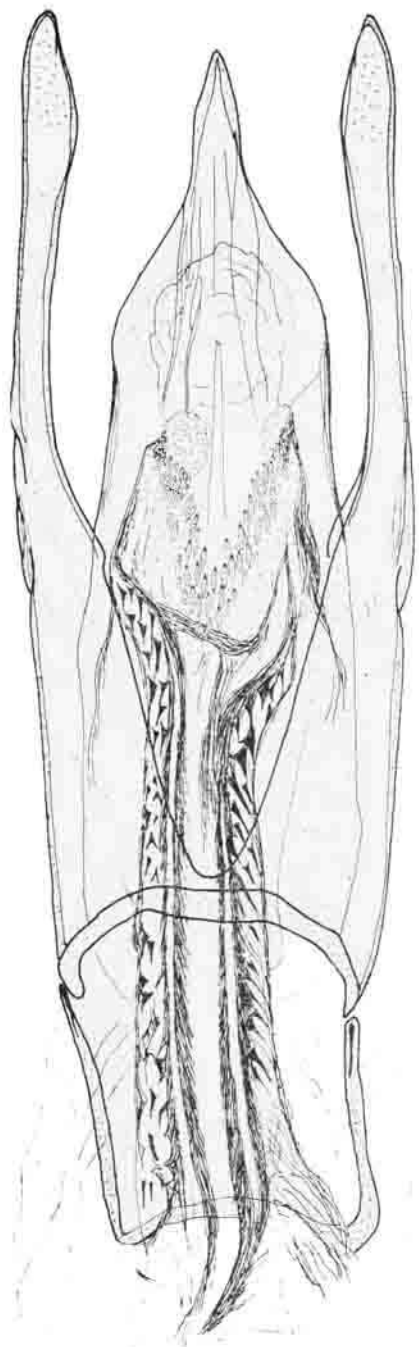
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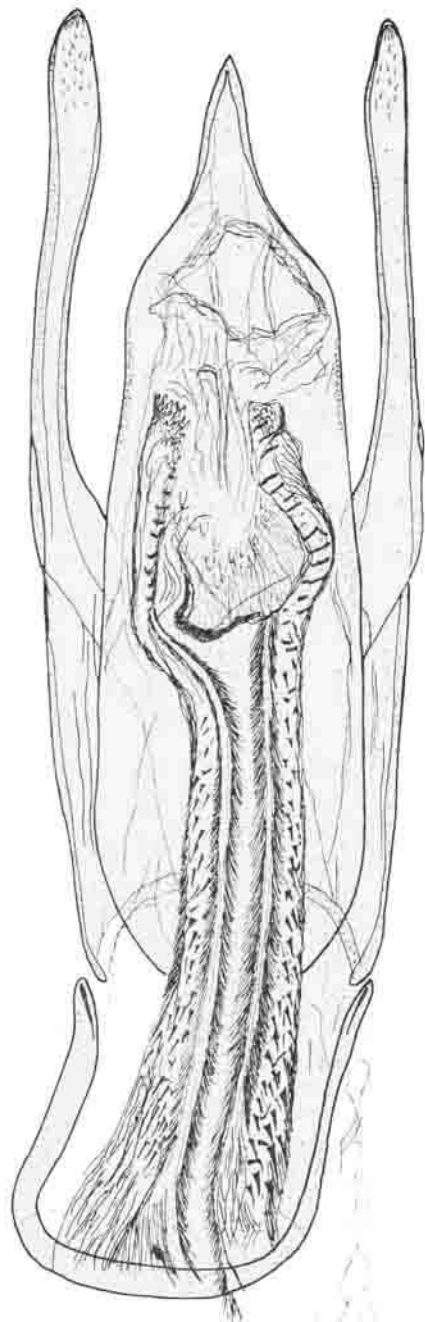
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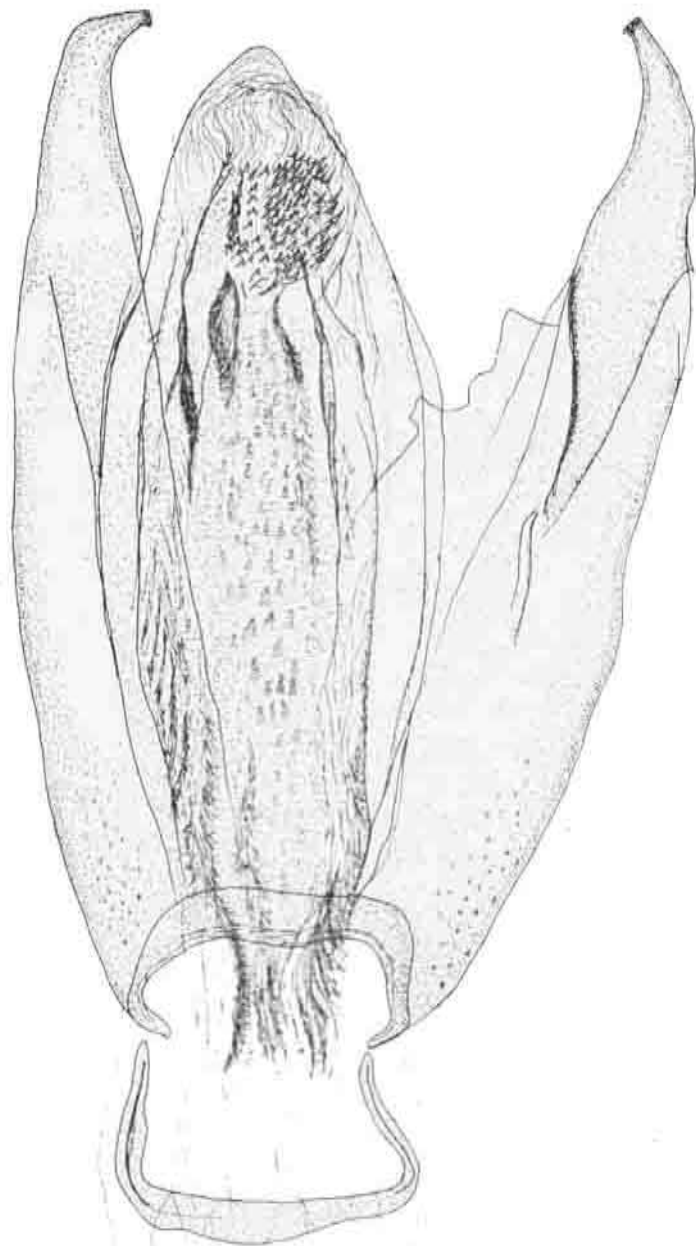
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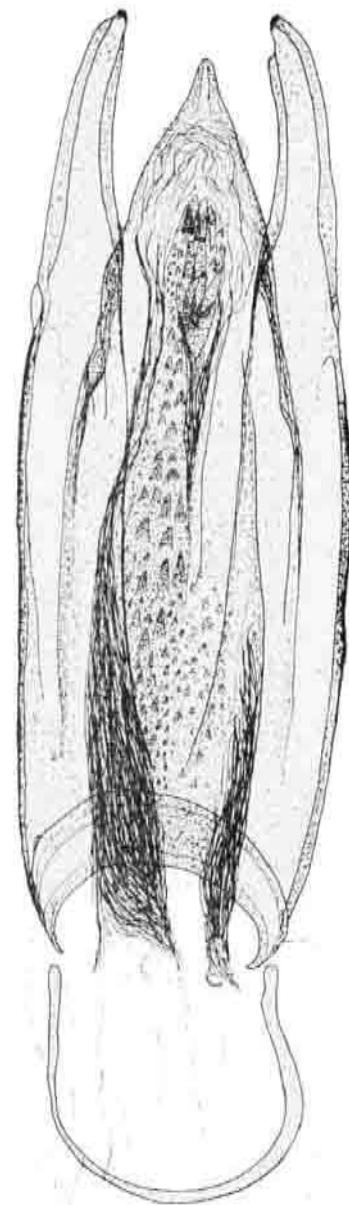
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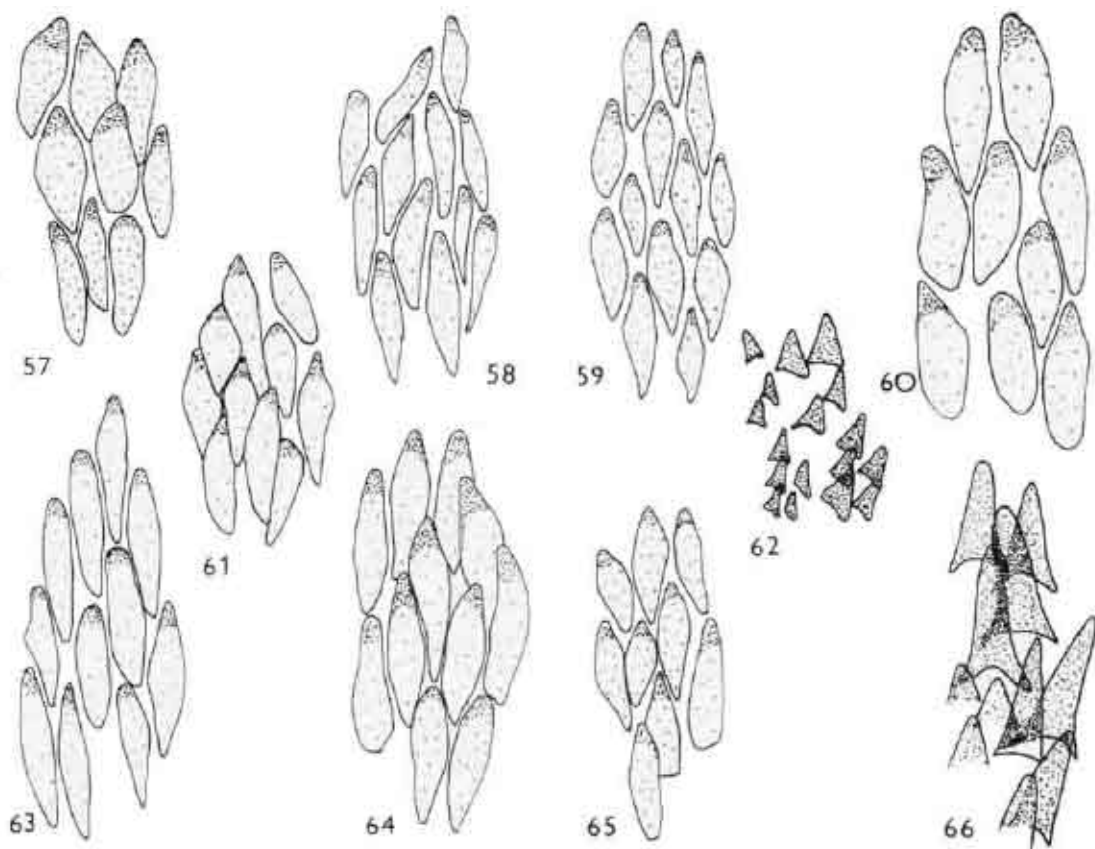


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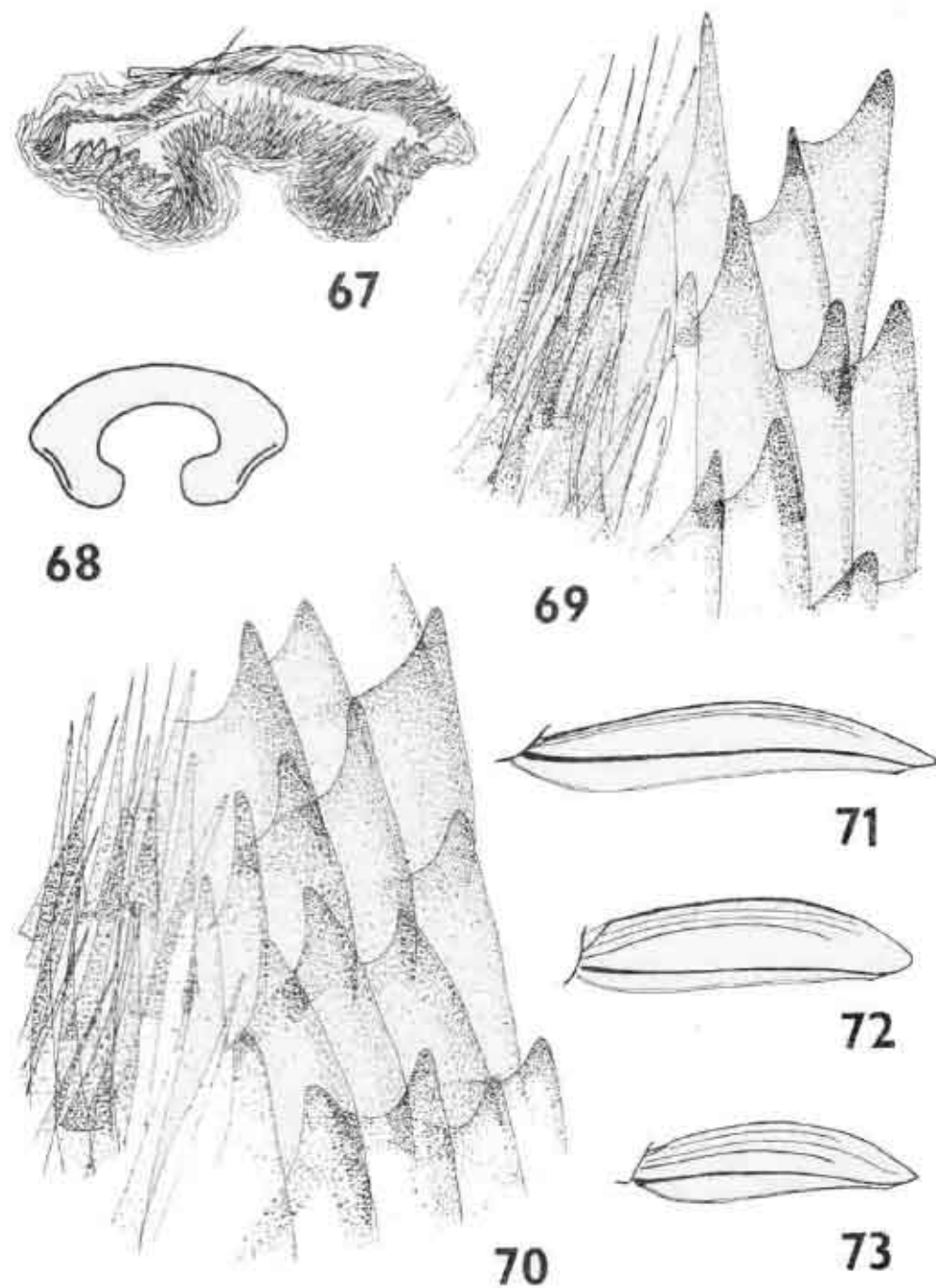


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Figs. 53–56. Aedeagus in *S. fatrica* (53–54) in dorsal and ventral view and aedeagus in *S. obscura* (55) and *S. oblonga* (56) in dorsal view



Figs. 57-66. Lamellae of the terminal part of internal sac of aedeagus in *S. carinata*, *S. tatraca*, *S. obscura* and *S. oblonga*. Fig. 57 - *S. carinata*, Moravia, Pavlovské kopce mountains; Fig. 58 - *S. carinata*, Moravia, Střelice; Fig. 59 - ssp. *austriaca*, Moravia, Jeseníky mountains; Fig. 60 - ssp. *austriaca*, Tyrolia; Fig. 61 - ssp. *atropurpurea*, Ural; Fig. 62 - *S. obscura*; Fig. 63 - ssp. *atropurpurea*, Kuban, Russia; Fig. 64 - ssp. *carinata*, Caucasus; Fig. 65 - *S. tatraca*; Fig. 66 - *S. oblonga*



Figs. 67-70. Microanatomical characters of aedeagus in *S. carinata*. Fig. 67 - transversal section of the median part of the internal sac in *S. carinata*. Fig. 68 - schematized transversal section of the median part of internal sac, Fig. 69 - arrow- and needle-shaped lamellae from the lateral side of ventral part of the internal sac in *S. carinata* ssp. *atropurpurea* (Russia, Kuban), Fig. 70: arrow- and needle-shaped lamellae from the lateral sides of ventral part of the internal sac in *S. carinata* ssp. *carinata* (Moravia, Pavlovské kopce mountains)

Figs. 71-73. Contours of dorsal surface of the body in *S. carinata carinata* (Fig. 71), *S. carinata italica* (Fig. 72) and *S. carinata austriaca* (Fig. 73) in lateral view

cences represent a single taxon identical with ssp. *carinata*, as indicated yet by KRAATZ (1876) partly. Only the taxa ssp. *italica*, ssp. *austriaca* and ssp. *carpathica* represent a group of morphologically distinguished ecomorphs. The subspecies *austriaca* and *carpathica* do not differ, if the extensive material is examined for characters given in the literature and for any other characters. This fact is evidenced also by false identifications of such authors as ROUBAL (1930). The confusion of their areas given in the literature (Fig. 28) and the above facts show that they represent a single taxon of a low status with fluent transitions to normal lowland *S. carinata*. Respecting the fact that this low taxon is distributed only in the higher altitude of Central European mountains (Alps, Šumava – Krušné hory – Krkonoše – Jeseníky – mountains and the Carpathians), it may be treated as *Silpha carinata austriaca* OTTO, 1891 due to any kind of geographical and ecological isolation. The name *carpathica* is obviously synonymous. The extremely small (12 – 15 mm), convex and shining individuals may be identified as belonging to this subspecies. The taxon *italica* has, similarly to ssp. *austriaca*, convex, rounded, shining and larger-sized body (17 – 20 mm). It can be treated as an independent subspecies due to its geographical isolation from other population of *S. carinata*. This subspecies represents probably a phylogenetically younger taxon than ssp. *austriaca*. As patent from Figs. 28 and 71, this form penetrated Northern Italy cross-

ing the Alps, and it represents a subform of ssp. *austriaca* which secondarily invaded more favourable environments on southern slopes of the Piedmonts, Dolomit-mountains and in Italian peninsula. The characters won in the high elevations of the Alps (convexity and the shining of body) preserved until today, but the colouration became secondarily black as in normal lowland forms, and the body size is large reaching the length of about 18 – 21 mm. It is to be mentioned that in the museum collection the giant individuals of *S. carinata* from ex-Italian territories are identified false as ssp. *italica*.

The other taxa mentioned above are identical with *S. carinata carinata* in all stabile characters. The ssp. *blattiformis* and ssp. *croatica* are normally coloured individuals of a large body. The body length of 20 – 23 mm given for ssp. *blattiformis* by REITTER (1901) does not correspond with types, which are 20 or 21 mm long. The taxa *atropurpurea*, *rufocincta* and *rufescens* include normally brown-coloured individuals of *S. carinata*. There are no visible differences in the shining of body, as given in the literature (REITTER, 1901; PORTEVIN, 1926). The subspecific status of taxa *atropurpurea* and *rufocincta* is intolerable also due to the overlapping areas (Fig. 28). The types of *S. c.* ssp. *rufocincta* are consubspecific with types of *S. c.* ssp. *atropurpurea*.

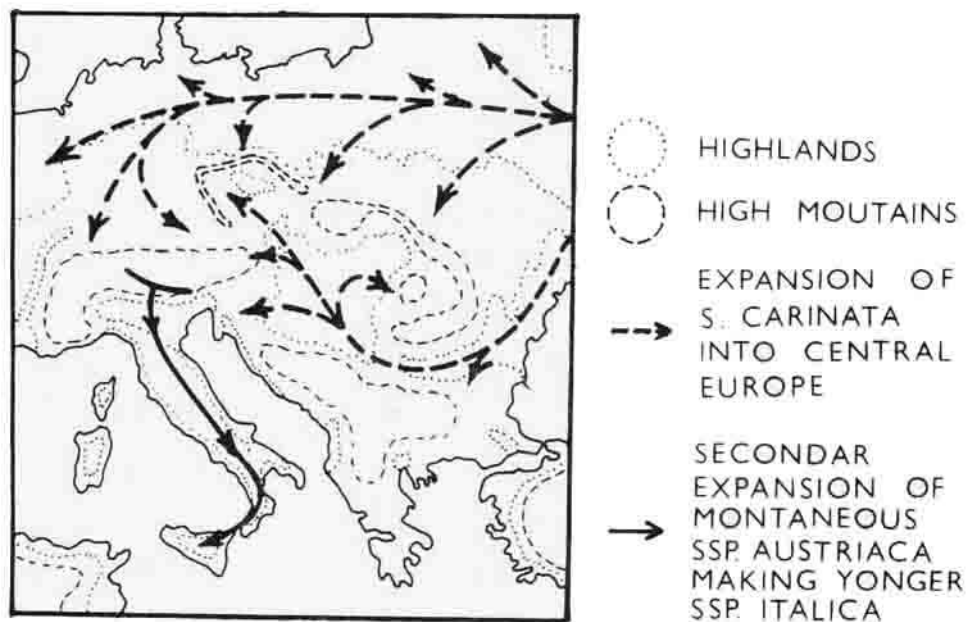


Fig. 74. The schema of probable expansions ways of *S. carinata* into Central Europe and crossing the Alps into Italy

Conclusion

The present analyses show that *S. bilineata*, *S. tatrica* and *S. carinata* represent a single, very variable, taxon. The extensive variability of this taxon was the reason that individual aberrant specimens were described as separate taxa when the limited and occasionally selected material was studied. In the frame of *S. carinata* it is possible to distinguish three subspecies of a rather distinctive ecomorphous character. These subspecies may be identified after following key.

- 1 (2) Body flat (Fig. 72), dim, black or black-brown, or brown coloured. Distributed in Central and Western Europe, Russia, Siberia and Transbaikalia, Caucasus and in Turkmenistan *S. carinata carinata*.
- 2 (1) Body convex (Figs. 73, 74), shining, black, black-brown or brown coloured.
- 3 (4) Body length 12 – 15 mm, black-brown or brown with black middle of pronotum. Distributed in the Alps, higher altitudes of Bohemian massif and in the Carpathians *S. carinata austriaca*.
- 4 (3) Body length 17 – 21 mm, always black *S. carinata italica*.

The single actually existing species *S. carinata* is to be treated definitely with following synonymy and subspecific taxonomy: *Silpha carinata* HERBST, 1783.

syn. *trilineata* LINNAEUS, 1790
lanata OLIVIER, 1790
marginalis KUGELAN, 1792
opaca HERBST, 1793
recta MARSHAM, 1802
Griechsbachiana STEPHENS, 1830
bilineata REITTER, 1901
tatrica SMETANA, 1952
 ssp. *carinata* HERBST, 1783
 syn. *armeniaca* KOLENATI, 1846
 atropurpurea KÜSTER, 1851
 rufocincta REITTER, 1901
 blattiformis REITTER, 1901
 croatica OBENBERGER, 1922
 rufescens PORTEVIN, 1926
 ssp. *austriaca* OTTO, 1891
 syn. *carpathica* REITTER, 1901
 ssp. *italica* KÜSTER, 1851

The genus *Silpha* is to be treated with the following synonymy: *Silpha* LINNAEUS, 1758

syn. *Parasilpha* REITTER, 1884
Carpathosilpha SMETANA, 1952

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