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THE *TRIFURCULA SUBNITIDELLA* GROUP (LEPIDOPTERA: NEPTICULIDAE): TAXONOMY, DISTRIBUTION AND BIOLOGY

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The nominal subgenus *Trifurcula* Zeller, 1848 is divided into two species groups: the *subnitidella* group and the *pallidella* group. The *subnitidella* group is described and comprises *T. subnitidella* (Duponchel, 1843), and eight new species: *austriaca* (from Austria), *luteola* (France), *puplesisi* (Soviet Union), *coronillae* (Spain), *victoris* (Spain), *josefklimeschi* (Italy, southern Europe), *iberica* (Spain) and *silviae* (France). Males of all species and females of six species are described and diagnosed, and for four species the larvae, mines and biology are described as well: they make mines in stems of herbaceous or shrubby Fabaceae (tribes Loteae, Coronilleae). The group is widespread in the western Palaearctic, but most species occur in Southwest Europe. *T. subnitidella* is recorded for the first time from 14 countries. The phylogeny of the group and subgenus are discussed, the *pallidella* group is considered to be its sistergroup. A lectotype for *T. orientella* Klimesch, previously confused with some species here described, is designated.

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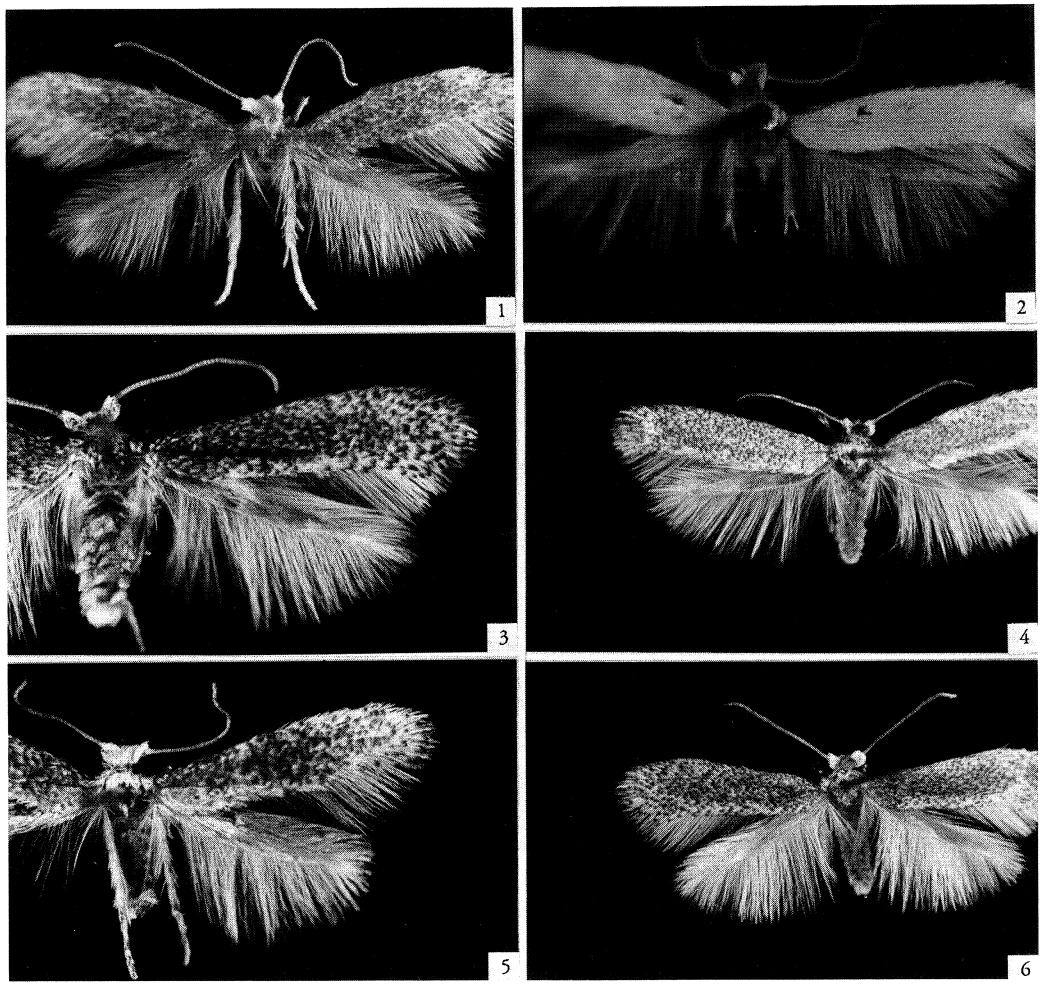
Keywords. – Nepticulidae, stem-miners, taxonomy, phylogeny, Palaearctic, Fabaceae.

The genus *Trifurcula* Zeller, 1848 constitutes an important part of the nepticulid fauna of the Mediterranean region with the total number of species probably exceeding 60 (31 described species: van Nieukerken 1986a). It is especially abundant in dry open habitats, such as grasslands, maquis and garrigue vegetations, where the larvae make leaf- or stem-mines in shrubby and herbaceous plants, in particular Lamiaceae (Labiatae) and Fabaceae (Leguminosae). A few species extend their ranges northwards into northern and western Europe. *Trifurcula* remains the main nepticulid taxon in Europe which needs extensive taxonomic revision.

The genus was fully redescribed by van Nieukerken (1986b), who recognized three subgenera: *Glaucolepis* Braun, *Levarchama* Beirne and *Trifurcula* Zeller. The ten Northwest European species have been treated by van Nieukerken & Johansson (1990), but no comprehensive work for the remaining European species is currently available.

The present paper is the first in a series of revisions of *Trifurcula*, which follows a few papers dealing with single species (van Nieukerken & Johansson 1986, van Nieukerken 1987). The subgenus *Trifurcula* was revised by Klimesch (1953), who recognized eight species, two of which are now considered to be junior synonyms. Only two species were added later, *T. griseella* Wolff, 1957 (later recognized to be a junior synonym of *T. subnitidella* (Duponchel, [1843])) and *T. beirnei* Puplesis, 1984, resulting again in a number of eight described species (van Nieukerken 1986a). These species only represent a minority of the actual number, which probably exceeds 25.

The described species are almost all relatively uniformly coloured moths, without striking external characters, and associated with various species of brooms (Fabaceae, tribe Genisteae). *T. subnitidella* forms an exception in having a conspicuous external character – a brand of bright yellow scales on the male forewing underside – and having an association with herbaceous Fabaceae (*Lotus*: van Nieukerken & Johansson 1990). In unidentified and misidentified material from southern Europe and western Asia eight species with similar external features have been found, and following recent field trips three of these species and *T. subnitidella* itself, have been reared from larvae collected on plants belonging to the tribes Loteae and Coronilleae. In this paper these species are assembled into the *T. subnitidella* species group, whereas the other palaearctic species in *Trifurcula* s. str. (with the type species *T. pallidella* (Duponchel, [1843])) are considered to form the *T. pallidella* species group.



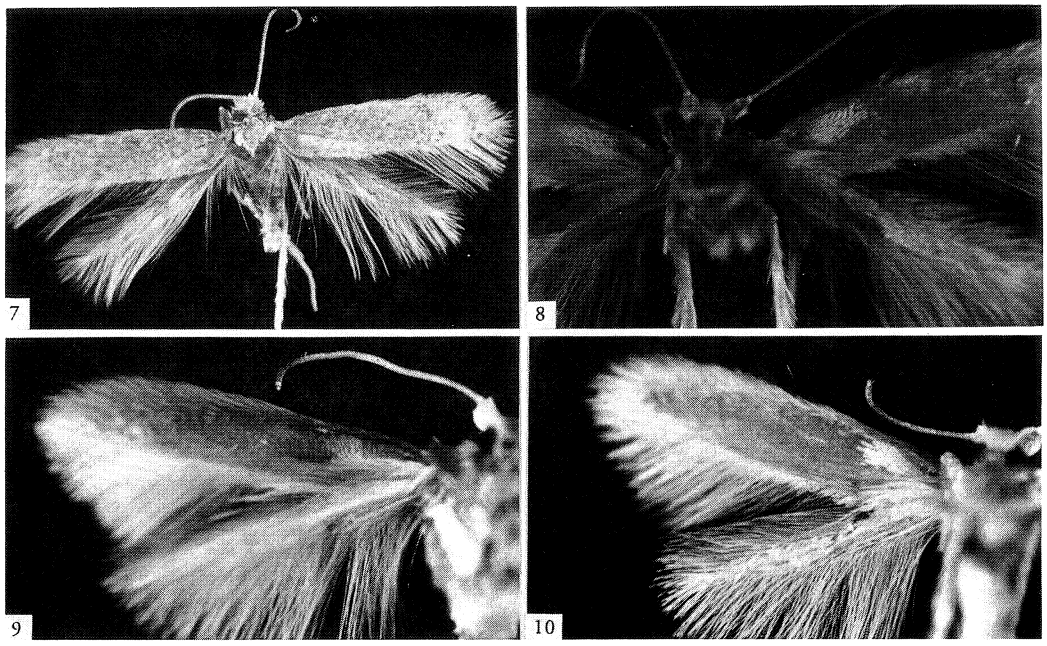
Figs. 1-6. *Trifurcula* spp., male habitus. – 1, *T. austriaca*, holotype; 2, *T. luteola*, paratype from type-locality; 3, *T. coronillae*, holotype; 4, *T. victoris*, holotype; 5, *T. subnitidella*, Spain, Camino de Ojen; 6, *T. josefklimeschi*, holotype.

When studying the material, representing the new species below, several specimens were found to be labelled as *T. orientella* Klimesch, 1953. This led me to re-examine *T. orientella* and select a lectotype for this species, which clearly belongs to the *pallidella* group. Other specimens treated here were found amongst material labelled as '*T. immundella* (Zeller)', '*T. pallidella* Zeller', '*T. serotinella* Herrich-Schäffer' and '*Nepticula cryptella* Frey'. Apparently, previous workers rarely examined the underside of the forewings of these tiny moths, which exhibit such good characters in this group.

MATERIAL AND METHODS

Larvae were collected by cutting portions of the stems of the hostplant, containing the mines. The stems were put in plastic boxes with a layer of paper tissue, in which the larvae could spin their cocoons. Next the cocoons or full-grown larvae were transferred into glass jars with a layer of soil and some moss. In the case of species from southern Europe, these jars were kept indoors (in The Netherlands), at room temperature, until emergence. Autumn collected larvae of *subnitidella* were, after spinning their cocoons, left in an outhouse for overwintering, and were brought indoors in March.

Methods for preparation of the genitalia are largely the same as in van Nieukerken (1985). In this group it is often very difficult to separate the aedeagus from the genitalia capsule and valvae, because of the tight connection with membranes. The aedeagus has therefore only been severed in some specimens, in order to study the complex morphol-



Figs. 7-10. *Trifurcula* spp., males. – 7, *T. silviae*, habitus, holotype; 8, *T. austriaca*, underside, holotype; 9, *T. subnitidella*, underside, Spain, Camino de Ojen; 10, *T. coronillae*, underside, holotype. Andraconial patch arrowed in figs. 8-10.

ogy of aedeagal processes and cornuti; in some specimens also the vesica was removed from the aedeagal tube to show the cornuti better. For identification purposes, removing of the aedeagus is not always necessary.

Larvae were treated with KOH 10% prior to cleaning and mounting with Euparal on slides. They were stained with Chlorazol black.

Line figures of genitalia were prepared with a Zeiss Standard microscope or Zeiss Axioskop, with camera and drawing apparatus, both from genitalia in glycerin and permanent mounts. In most cases cornuti are drawn separate from the aedeagus; only the characteristic larger cornuti are depicted, the smaller ones being almost similar in all species. Line drawings of mines were made from herbarium specimens, after boiling for some minutes in distilled water: frass may be better visible in such soaked mines than in fresh ones.

Photographs of genitalia and larval head capsules were taken with a Zeiss Axioskop microscope and camera.

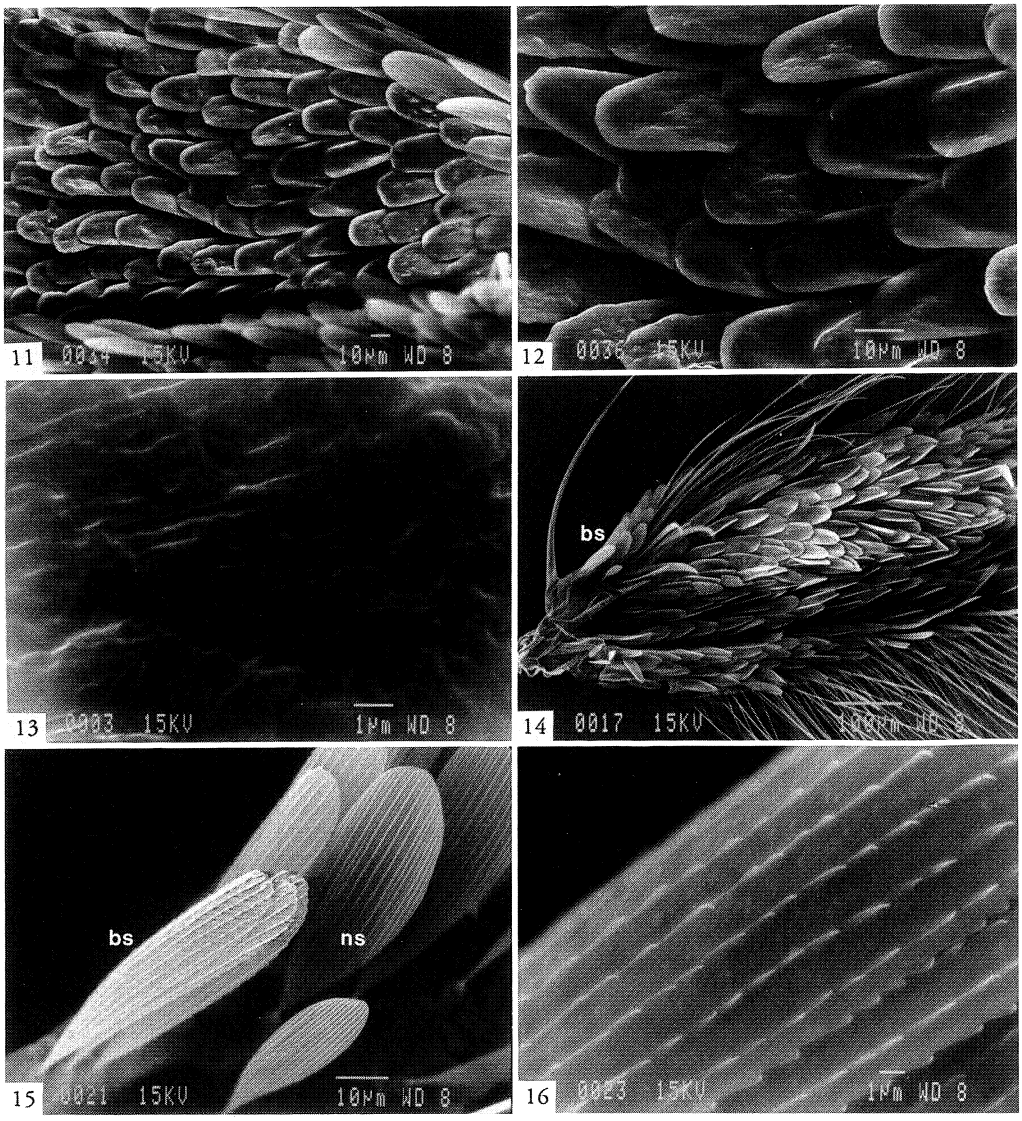
SEM micrographs were taken with a Jeol JSM 840A scanning electron microscope. Specimens were air-dried, mounted on stubs and gold-coated.

Measurements of genitalia are taken with a Zeiss Axioskop or Universal Microscope, at 200 ×, and are accurate at the nearest 5 μm. All measurements based on sample size of at least five specimens are accompanied by mean, standard deviation and sample size in brackets.

Distribution maps are based on material examined, but for *T. subnitidella* also literature data and personal communications have been used. Locality names are spelled in accordance with the Times Atlas of the World (Comprehensive edition, 1975 and later), deviating names on labels are cited in brackets. For all localities the appropriate UTM grid references (10 × 10 km, or 1 × 1 km for authors' records) are given. These are used for plotting the distribution on the 50 × 50 km squares of the maps provided by the 'European Invertebrate Survey'. The UTM grid references were obtained directly from 'Tactical Pilotage Charts 1:500,000', topographical maps, or calculated from geographical coordinates (obtained from atlases, various maps or US gazetteers), using the computer program 'UTM' by Rasmont & André. Most of the British records, however, are an approximation of the correct UTM square, since they are based on vice-county records and dots on a vice-county map, provided by A. M. Emmet (in litt.).

Nomenclature of hostplants follows Heywood & Ball (1968), but the family name Fabaceae is used in stead of Leguminosae.

Abbreviations (codens) for depositories follow Arnett & Samuelson (1986), with the addition of: ETO (for collection E. Traugott-Olsen, Marbella,



Figs. 11-16. *Trifurcula subnitidella*, male, details of wings, scanning micrographs. – 11, forewing underside with yellow scale patch, some normal wing scales in upper right corner; 12, 13, details of androconial scales; 14, hindwing with frenulum and group of 'black' scales; 15, idem, detail; 16, ultrastructure of 'black' scale. bs = black scales; ns = normal scale.

Spain), GBA (for collection G. Baldizzone, Asti, Italy) and ZKVV (Zoologijos Katedra VPI, Vilnius, Lithuania). Note that in the index of Arnett & Samuelson the coden NHMW is misspelled as NHMV. RMNH remains the coden for the National Museum of Natural History, Leiden, Netherlands (formerly Rijksmuseum van Natuurlijke Historie). Genitalia slide numbers refer to the numbering system of the author, unless accompanied by another abbreviation.

TAXONOMIC PART

For descriptions of the genus *Trifurcula* Zeller, 1848 and its typical subgenus refer to van Nieukerken (1986b) and van Nieukerken & Johansson (1990). This subgenus is here divided into two species groups, recognized according to the following key:

1. Forewing underside in male with a patch of yellowish androconial scales near base (except in *T. silviae*); in addition hindwing costa often with row or group of dark brown or black special scales. Male genitalia: gnathos often atypical: either with serrations, keels, projections or completely asymmetrical, occasionally simple and symmetrical. Aedeagus usually with dorsal lobe at right side; large cornuti (3) not curved and horn-like (except in *austriaca*). Larvae stem-miners in tribes Loteae or Coronilleae (Fabaceae) ..... *subnitidella* group
- Forewing underside and hindwing costa in male without androconial or special scales. Male genitalia: gnathos simple, symmetrical. Aedeagus usually with dorsal lobe at left side; at least one or two large cornuti strongly curved, horn-like. Larvae stem-miners in brooms: tribe Genisteae ..... *pallidella* group

The following nominal species are here assigned to the *pallidella* group: *Trifurcula pallidella* (Duponchel, [1843]) (= *incognitella* Toll, 1936), *T. immundella* (Zeller, 1839), *T. serotinella* Herrich-Schäffer, 1855 (= *confertella* Fuchs, 1895), *T. orientella* Klimesch, 1953, *T. aurella* Klimesch, 1953, *T. beirnei* Puplesis, 1984 and *T. squamatella* Stainton, 1849 (= *maxima* Klimesch, 1953). Also the undescribed species from Sumatra (see van Nieukerken 1986b) belongs here. This group will be the subject of a future revision.

The *Trifurcula subnitidella* group

Description

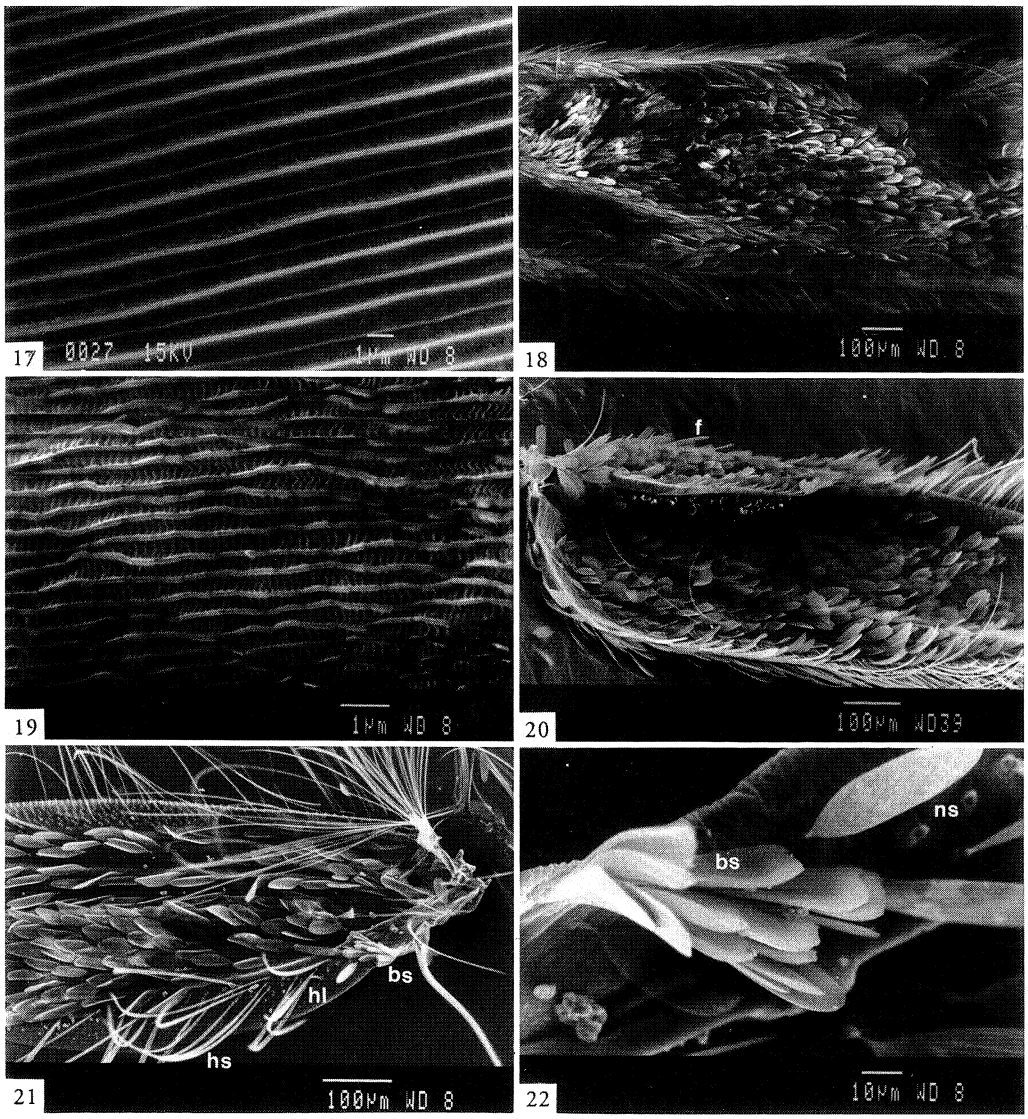
Adult (figs. 1-7). – Forewing length 2-3.5 mm. Antenna with 27-48 segments, in male with more flagellar segments than in female. Forewing upperside uniformly pale or irrorate by dark tipped scales, mixed with pale scales. No other colour pattern present. Venation as described for subgenus (van Nieukerken 1986b, van Nieukerken & Johansson 1990).

Underside of forewing in male with a distinct patch of lamellar androconial scales near wing-base (figs. 8-10), usually yellow or yellowish white, occasionally with various tinges of yellow (this patch is absent in *T. silviae*). The patch consists of scales, which are ultrastructurally different from normal wing scales (fig. 11) (see also van Nieukerken et al. 1990). In *subnitidella* these scales have almost no ultrastructure (figs. 12, 13), although remnants of scale-ribs are visible on some scales. In *coronillae* the three differently coloured areas also appear to have different ultrastructure: the basal area is much similar to the patch of *subnitidella* (not illustrated), but the scales in the central area have an irregular pattern of ribs (fig. 19). Forewing costa often with distinct costal fold on underside, in *josefklimeschi* extremely large (figs. 20, 58).

Hindwing underside in male with terminal velvet-like patch of raised scales (generic character) (illustrated by van Nieukerken 1986b and van Nieukerken et al., 1990). Costa of hindwing in several species slightly enlarged (fig. 21), in some species provided with a short or longer row of distinct black androconial scales (figs. 57-60). These scales also differ ultrastructurally from normal wing scales (figs. 15, 16, 22). In fig. 15 both the black scales and normal wing scales are shown, the ultrastructure of the normal scale is illustrated in fig. 17. The androconial scales are completely jet-black, or dark-brown in *silviae*, and have spiny ribs, with the intercalary area almost devoid of structure, apart from some indistinct bulges (fig. 16). Male without costal bristles, but often with long white hair-scales instead.

Male genitalia (figs. 23-88 in part). – Vinculum anteriorly rounded, truncate or slightly concave. Uncus with central process pointed or terminally widened, occasionally bilobed. Gnathos occurs in two forms: either symmetrical, with rounded or triangular central element, or asymmetrical and complex, provided with keel(s) or with serrate margin or with a combination of both; anterior apodemes usually present, but not always well sclerotized. Valva elongate, more or less triangular, or in some species with broader basal part. Aedeagus joined by juxta (ventral process) to valvae and capsule. Aedeagal tube asymmetric, complicate, tapering posteriorly both in lateral and ventral view; ventrally ending in a pointed or serrate (fringed) medial carina, which hinges to the juxta, dorsally ending in a pointed or spatulate tip, often indistinct, and in addition usually with a dorsal lobe at right-hand side, in *austriaca* at left-hand side. Vesica with complex set of cornuti: a group of about 10-20 long needle-like cornuti at right-hand side (dorsally in lateral view), many smaller cornuti of variable shape spread throughout vesica and usually three larger cornuti near phallotrema: a long smooth spine, often protruding from phallotrema, basally connected to a smaller cone-shaped cornutus; in addition another large, often irregular cornutus is often hidden amongst the group of spine-like cornuti, it may also protrude from the aedeagal tube. Sometimes both large cornuti are very similar, and other cornuti may be more reduced in size and number. In *coronillae* the dorsal lobe has a spiny process, which in normal slides is inseparable from the cornuti (fig. 49).

Female genitalia (figs. 89-100). – In general as in (sub)genus. Terminal segments either broad and blunt, or slightly pointed. Ductus bursae relatively wide; corpus long, covered with minute pectinations; signa usually long and narrow: a thickened margin encloses some rows of complete cells, out-



Figs. 17-22. *Trifurcula* spp., male, details of wings. – 17, *T. subnitidella*, ultrastructure of normal wingscale from fig. 15; 18, *T. coronillae*, forewing underside with yellow patch, different areas numbered from wingbase; 19, idem, ultrastructure of scale from area 2; 20, *T. josefklimeschi*, forewing underside with costal fold and androconial scale patch underneath; 21, idem, hindwing with humeral lobe and 'black' scales, costal margin below; 22, idem, detail. bs = black scales; f = fold; hl = humeral lobe; hs = hairscales.

side this margin there is a row of incomplete larger cells. Ductus spermathecae with less than 5 coils.

Final instar larva (figs. 101-104). – Body extremely elongate, deep yellow in colour. Head with frontoclypeus almost rectangular, tentorial arms short. Labrum with two pairs of setae: a medial and a lateral. Labial palpi three segmented. Antenna with sensilla not cross-wise. Prothorax with small ventral sclerite and a pair of narrow dorsal sclerites. Thorax with respectively 13, 12 and 10 setae pairs, abdominal segments 1-8 with 6, segment 9 with 3 and 10 with 2 setae pairs in all species examined. Integument with reduced spinosity, usually only spines ventrally and laterally upwards to the spiracles; spines usually short and inconspicuous. Anal rods posteriorly bifid. The four species described below can hardly be distinguished as larva, except by size, length/width ratio of the headcapsule and slight differences in spinosity.

Diagnosis

Males of the *subnitidella* group are recognized by the presence of a yellow androconial patch on the forewing underside, in some species in combination with black scaling along the hindwing costa. In *T. josefklimeschi* the patch is hidden under a large costal fold, in *silviae* the patch is absent, but there are rows of dark brown to black scales along the margin of the forewing costal fold and along the hindwing costa. Males of several species in the subgenus *Glaucolepis* Braun (such as *T. stoechadella* (Klimesch) and *T. saturejae* (Parenti)) also have patches of androconial scales on the underside of the forewing: they are either farther away from the wing base or extend over almost the whole wing surface; these species also differ in venation and genitalia (see van Nieukerken & Johansson, 1990).

Females cannot be differentiated externally from other *Trifurcula* species. The female genitalia differ from other *Trifurcula* s. l. species by a combination of the typical shape of signa as described above and the relative short ductus spermathecae with few coils. However, some species of the *Trifurcula pallidella* group have similar female genitalia.

Biology

The biology of this group has not been described prior to the recent discovery of the biology of *T. subnitidella* (van Nieukerken & Johansson 1990). The hostplant and larva of four of the species described here are known through rearing. The larvae of these species make stem-mines in herbaceous or shrubby species of Fabaceae, belonging to the genera *Lotus*, *Dorycnium*, *Anthyllis* or *Coronilla*, see table 1. The stem-mining species of this group are often sympatric with and feeding within centimeters of leaf-mining species of the subgenus *Trifurcula* (*Levarchama*), which have a very similar host-range: on *Lotus* we find *T. subnitidella* together with either *T.* (*L.*) *eurema* (Tutt) or *T.* (*L.*) *cryptella* (Stainton); on *Dorycnium*, *T. josefklimeschi* occurs together with *T.* (*L.*) *eurema* and on *Anthyllis cytisoides* we found *T. victoris* on the same plants as *T.* (*L.*) *anthyllidella* Klimesch. Hitherto all species of the *subnitidella* group are found on a single hostplant genus only.

The egg is deposited on the stem of the host, in one species on a leaflet. The larvae make relatively straight gallery mines in the green bark of the stem, usually changing direction of feeding several times (figs. 105-107). Larvae feed with their venter towards the epidermis. The full-grown larva quits the mine through a semicircular slit, and spins a cocoon on the soil or in leaf-litter.

The life history is still incompletely known. It is assumed here that most species are univoltine, albeit with a long flight period, but bivoltinism is not excluded, and well possible for *T. subnitidella* and *josefklimeschi*. The mediterranean species have been collected as larvae in January, February and April, and *T. subnitidella* larvae have been found in September and October in The Netherlands. Most specimens of *subnitidella* and *josefklimeschi* emerged within a short period, but *T. coronillae* and *victoris* specimens emerged over a period of several months.

Table 1. Hostplants of *Trifurcula subnitidella* group, all in family Fabaceae (Papilionaceae).

Hostplant	species of *Trifurcula*
Tribus Loteae	
Dorycnium hirsutum (L.) Ser.	7. *T. josefklimeschi*
D. pentaphyllum Scop.	7. *T. josefklimeschi*
Lotus corniculatus L.	6. *T. subnitidella*
Anthyllis cytisoides L.	5. *T. victoris*
Tribus Coronilleae	
Coronilla juncea L.	4. *coronillae*

Although the hostplant and immature stages of the other five species are unknown, it is tentatively assumed that they feed on related hostplants (herbaceous Fabaceae) and make stem-mines as well. The first assumption is supported by the localities of several of these species: they have been found in grassland habitats without any species of broom, the most likely alternative hosts in this subgenus. *T. iberica* and *silviae* have been found in alpine meadows, where herbaceous Fabaceae are abundant and *T. puplesisi* occurs in western Asia, beyond the natural range of broom species.

Adults of the *subnitidella* group have been collected by sweeping in grasslands and at light. They are, however, easily overlooked, and the search for mines is a more secure way to obtain records.

Distribution

The group has a wide distribution in the western Palaearctic region, but only *T. subnitidella* is widespread. The other species center around the mediterranean, currently with the highest number of species in Spain (5), southern France (3) and eastern Austria (3). One species, *T. puplesisi*, has a much more eastern distribution: around the Caspian Sea and in the western part of the Central Asian deserts, it is the easternmost Palaearctic species of *Trifurcula* s. str. The scarcity of records from Greece and northern Africa presumably is biassed by collecting activities.

Checklist of the *Trifurcula* subnitidella group

Trifurcula Zeller, 1848
subgenus *Trifurcula* s. str.

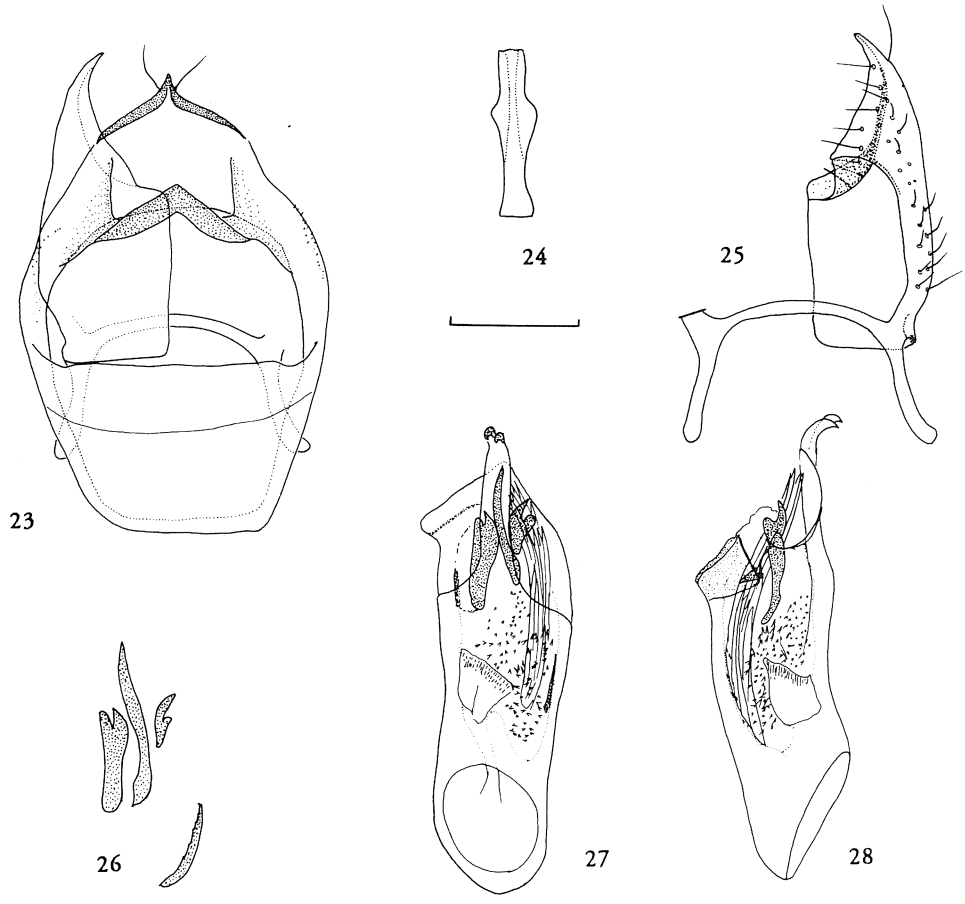
subnitidella species group
1. *austriaca* sp. n.
2. *luteola* sp. n.
3. *puplesisi* sp. n.
4. *coronillae* sp. n.
5. *victoris* sp. n.
6. *subnitidella* (Duponchel, 1843)
   griseella Wolff, 1957
7. *josefklimeschi* sp. n.
8. *iberica* sp. n.
9. *silviae* sp. n.

Key to the males of the *Trifurcula subnitidella* group

1. Underside of forewing with a well exposed patch of yellow(ish) androconial scales near wing base (figs. 8-10). Hindwing costa with or without some black scales 2
- Underside of forewing with large costal fold, hiding the distinct androconial patch (figs. 20, 58). Hindwing costa with enlarged lobe, a small group of black scales just behind frenulum (fig. 58)..... 7. *T. josefklimeschi*
- Underside of forewing without yellow patch, but margin of costal fold with row of dark-brown or black special scales; a row of similar scales along hindwing costa (fig. 60). Pale alpine species..... 9. *T. silviae*

2. Yellow patch divided into three well-separated areas with different tinges: from yolk yellow, through yellowish white to grey-brown (figs. 10, 18). Hindwing costa without black scaling ..... 4. *T. coronillae*
- Yellow patch with only one colour. Hindwing costa with or without black scaling..... 3

3. Hindwing costa with black scales extending from about ¼ to ½ (fig. 59)..... 8. *T. iberica*



Figs. 23-28. *Trifurcula austriaca*, male genitalia holotype, slide 2591 (except fig. 28). – 23, Capsule, valva outlined; 24, Juxta; 25, Valva, dorsal aspect; 26, Larger cornuti from paratype, slide Klimesch 757, slightly squashed; 27, Aedeagus, ventral aspect; 28, Idem, lateral aspect. Scale 0.1 mm.

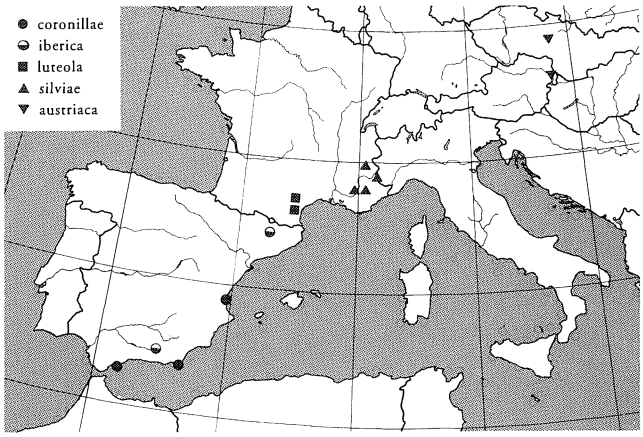


Fig. 29. Distribution of *Trifurcula* species, see legend. Mapped on 50 × 50 km UTM squares.

- Hindwing either with very small group of black scales near frenulum or without such scales 4
4. Hindwing costa with a small row of black scales just behind frenulum (fig. 57) (difficult to detect). Antenna with 31-36 segments. Gnathos asymmetrical, with a small keel at right side (fig. 61) ..... 6. *T. subnitidella*
- Hindwing costa completely without black scaling. Antenna with 34-48 segments. Gnathos either asymmetrical with two keels, or symmetrical 5
5. Small species (forewing length 2.6-2.9 mm), with 34-37 antennal segments. Androconial patch (fig. 8) yellowish white, similar scales also present on hindwing upperside. Aedeagus with two curved cornuti and one spine-like cornutus (fig. 26) ..... 1. *T. austriaca*
- Larger species (2.8-3.5 mm), with 40-48 antennal segments. Androconial patch a darker yellow. Aedeagus without curved cornuti, but with one or two spine-like and a conical cornutus 6
6. Gnathos asymmetrical, with two large keels (fig. 51, 52). Aedeagus with two very similar spine-like cornuti ..... 5. *T. victoris*
- Gnathos simple, symmetrical (figs. 30, 37). Aedeagus with three differently shaped larger cornuti 7
7. Very pale species: scale tips yellow (fig. 2). Valva almost triangular, gradually narrowing towards apex (fig. 33). Species from western France ..... 2. *T. luteola*
- Darker species: scales with darker tips. Valva basally with almost parallel margins, distally suddenly tapering towards apex (fig. 38). Species from west Asia ..... 3. *T. puplesisi*

1. **Trifurcula austriaca** sp. n.
(figs. 1, 8, 23-28, 29)

Trifurcula n. sp.; van Nieukerken *in* Kasy 1985: 5.

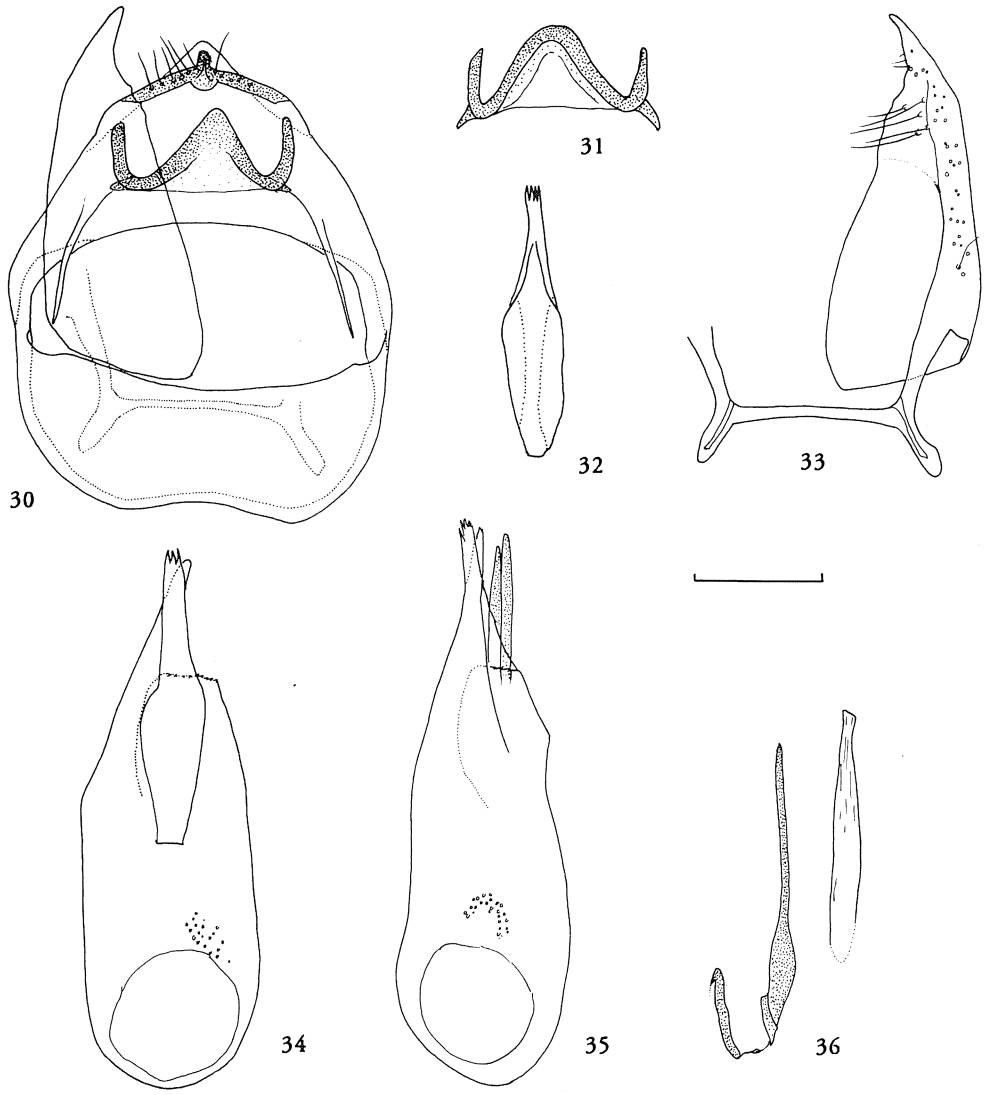
Type material. – Holotype ♂, Austria: Fürbachwiesen, E. of Gramatneusiedl (Niederöst.), UTM: 33U XP12, 15.v.1968, F. Kasy, Genitalia slide EvN 2591 (NHMW). – Paratypes, 2 ♂: same data, but 4.ix.1973, 31.vii.1978 (RMNH, NHMW).

Description

Male (fig. 1). – Forewing length 2.6-2.9 mm, wingspan 5.6-6.7 mm. Head: frontal tuft yellowish orange, collar yellowish white. Antenna with 34-37 segments; scape yellowish white, sometimes with a few dark scales. Forewing and thorax covered with fuscous tipped scales, mixed with white scales, giving a grey-brown impression; terminal cilia white beyond relatively distinct cilia-line. Underside of forewing with basal patch buff yellow, extending to ¼ (fig. 8). Hindwing with a row of white hair-scales in stead of costal bristles; basally on upperside with some yellowish white to buff yellow scales, similar to forewing underside.

Female unknown.

Male genitalia (figs. 23-28). – Capsule length 330-350 μm. Vinculum anteriorly slightly narrowed, truncate; lateral arms near gnathos with minute spines. Uncus with medial process pointed, with pair of lateral setae. Gnathos symmetrical, central element triangular, with wide apical angle; anterior processes present. Valva length 245-255 μm, basally broad, with parallel margins, posterior half suddenly narrowed towards short pointed tip, transverse bar of transtilla less than twice the length of sublateral process. Aedeagus 310-385 μm



Figs. 30-36. *Trifurcula luteola*, male genitalia. – 30, Capsule, valva outlined, slide 2342; 31, Gnathos, holotype, slide 2303; 32, juxta, holotype, slide 2303; 33, Valva, dorsal aspect, slide 2342; 34, Aedeagus, ventral aspect, holotype, slide 2303; 35, Aedeagus, ventro-lateral aspect, slide 2304; 36, Larger cornuti, holotype, slide 2303. Scale 0.1 mm.

long, with ventral carina posteriorly ending in two ventrally curved processes; dorsal lobe at right side indistinct, a large lobe at left side, ventrally enlarged and strongly sclerotized (fig. 27, 28). Vesica with three large cornuti (fig. 26): one long pointed (-135 μm) and two curved (respectively 85 and 60 μm); further a serrate cornutus lower in vesica, in addition to the group of needle-like and the small cornuti. Juxta fig. 24.

Diagnosis

Externally most similar to *subnitidella*, but without black scales near frenulum; *austriaca* also has special scales on hindwing upperside. Other species without black scales are larger and/ or paler (*luteola*, *puplesisi*, *victoris*). Male genitalia resemble more those of the *T. pallidella* group than other species in this group: the two curved cornuti and the triangular gnathos are diagnostic.

Biology

Immature stages and hostplant unknown. The adults were all taken at light, from May to September, in a grassland nature reserve, with a very rich Lepidoptera fauna (Kasy 1985).

Distribution (fig. 29)

Eastern Austria: only from the type locality: the 'Pischeldorfer Fischawiesen' (named Fürbachwiesen on labels). After finishing this description, Z. Laštúvka showed me in August 1990 a drawing of male genitalia undoubtedly belonging to this species, from a specimen from Czechoslovakia: Prostějov Hamry [UTM: 33U XQ48], collected in 1990; this record is added on fig. 29. Possibly a species with an eastern distribution, like several other Lepidoptera species occurring in this area.

Etymology

An latinized adjective, from the type locality Austria.

2. **Trifurcula luteola** sp. n.
(figs. 2, 29, 30-36)

[*Trifurcula pallidella* Duponchel partim; Lhomme [1963]: 1209. Misidentification.]

Type material. – Holotype ♂: France, Molières[-sur-l'Alberte] (Aude), UTM: 31T DH57, 6.viii.1903, Chrétien, Genitalia slide EvN 2303 (MNHN). – Paratypes: 4 ♂. France: 1 ♂ (abdomen missing), data as holotype (MNHN); 1 ♂, Arten. [St. Pons, montagne d'Artenac] (Hérault), UTM: 31T DJ81, 19.vii.1904, Chrétien (MNHN); 2 ♂, Nesp. [Nespouls, near St. Pons] (Hérault), UTM: 31T DJ81, 2.viii.1904, (MNHN, RMNH).

Description

Male (fig. 2). – Forewing length (2.4) 3.2-3.4 mm, wingspan (5.4) 7.2-7.6 mm. Head: frontal tuft yellowish orange, collar paler. Antenna with 40-45 segments; scape white with few yellow scales. Forewing and thorax pale yellowish white, tips of scales yellow; terminal cilia concolorous. Underside of forewing with orange yellow basal patch to ⅓, costal fold with row of brown scales along edge. Hindwing white, humeral lobe on upperside near frenulum with a row of yellowish-orange special scales.

Female unknown.

Male genitalia (figs. 30-36). – Capsule length 370-375 μm. Vinculum anteriorly truncate, broad and short. Uncus with medial process terminally truncate, not widened, several lateral setae. Gnathos symmetrical, central element approximately triangular, slightly angular or more rounded (figs. 30, 31); long anterior apodemes present, but not very distinct. Valva length 280-305 μm, roughly triangular, with short pointed tip; transverse bar of transtilla 2.5-3 × as long as sublateral process. Aedeagus 405-435 μm long, with long, terminally fringed, ventral carina; vesica with one long, pointed cornutus (225-250 μm), a short conical (75 μm), ± 10 long needle-like and many small cornuti. Aedeagal tube with dorsal lobe at right side not very pronounced, slightly serrate. Juxta fig. 32.

Diagnosis

Externally easy to separate from most other species by pale colour and size. Resembles *Trifurcula pallidella* (Duponchel), but male easily distinguished by yellow patch on forewing underside. Male genitalia characterized by triangular valva and triangular, symmetrical gnathos, but see *puplesisi*.

Biology

Immature stages and hostplant unknown. Adults collected in July and August.

Distribution (fig. 29)

Only known from Southwest France, in mediterranean region.

Remarks

The four specimens of this species were found amongst material labelled as *Trifurcula pallidella* in the Chrétien collection. Although the species has only been collected in the beginning of this century, it is very well possible that it still can be found, but has until now been overlooked, as was the case with *silviae*.

Etymology

A Latin adjective, from *luteolus* = yellow, orange, named after the pale forewing colour.

3. **Trifurcula puplesisi** sp. n.
(figs. 37-44, 89, 95)

Type material. – Holotype ♂: Soviet Union: Turkmenistan, Sandykachi (Sandy Katschi), UTM: 41S MA55, 1.v.1986, Puplesis, Genitalia slide EvN 2760 (ZKVV). – Paratypes: 2 ♂, 4 ♀. Soviet Union: 1 ♂, 2 ♀, same data as holotype; 2 ♀, Turkmenia, Central Karakum, env. Ashkhabad, UTM: 40S FH20, 4.vi.1988, R. Puplesis (ZKVV, RMNH); 1 ♂, [Derbent (Dagestan), UTM: 39T TG76], 10.vii.[1872], ['Nacht bei Ligt'], Christoph, '473', Zeller Coll., Walsingham collection (BMNH).

Excluded from type-series (probably conspecific): 1 ♂, Krasnoarmeysk (Sarepta), UTM: 38U MX77, Christoph, '397' [red label] (BMNH).

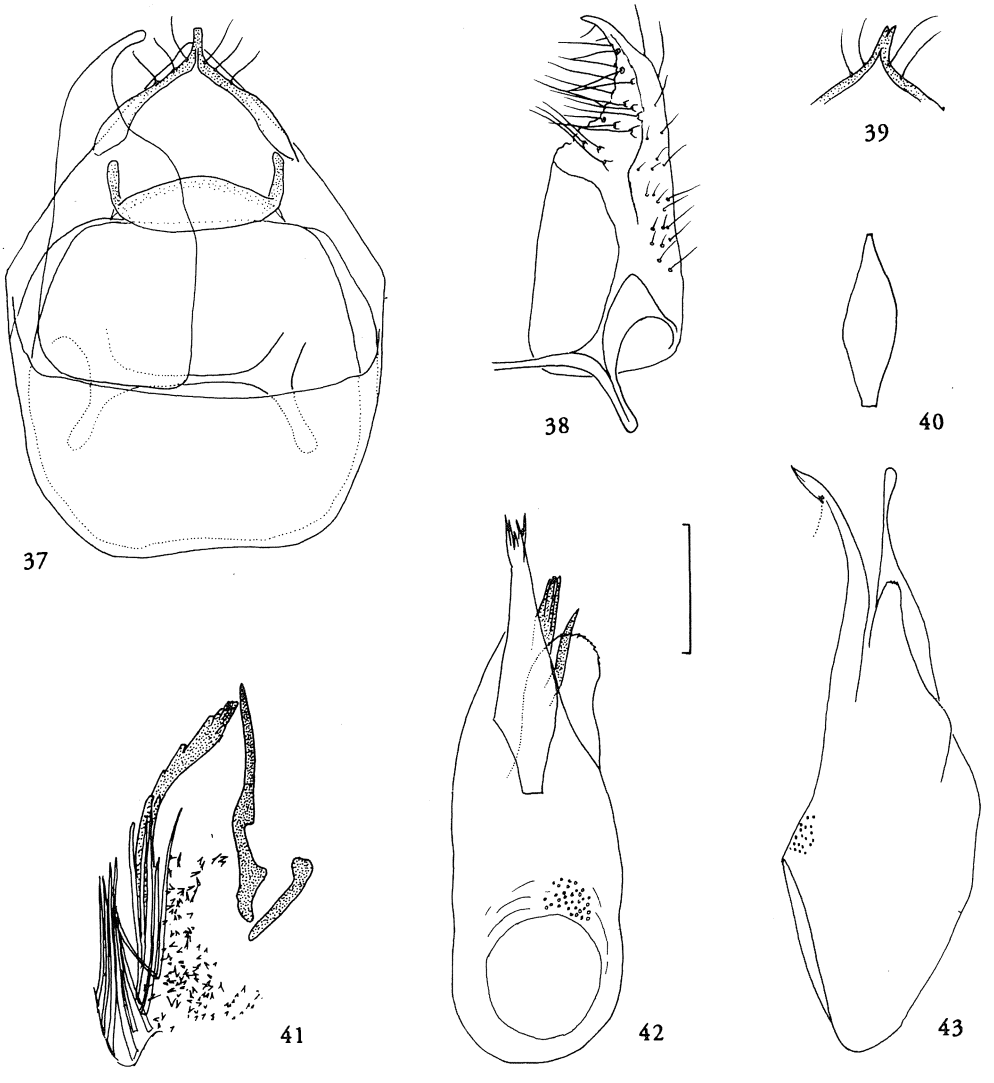
Description

Male. – Forewing length 2.9-3.7 mm, wingspan 6.2-8.0 mm. Head: frontal tuft pale wish orange to almost white, collar white. Antenna with 46-48 segments; scape white. Forewing and thorax greyish brown, scales with dark tips, except along dorsum; terminal cilia white. Underside of forewing with a small pale yellow basal patch to ⅕.

Hindwing white, humeral lobe on upperside near frenulum with some yellow special scales, similar to those on forewing underside; costa basally with row of white hair-scales.

Female. – Forewing length 3.2-3.3 mm (3.25 ± 0.04, 4), wingspan ca 7.3 mm. Antenna with 43-45 segments.

Male genitalia (figs. 37-43). – Capsule length 350-410 μm. Vinculum wide and short, anteriorly broadly rounded. Uncus with medial process terminally truncate or bifurcate (figs. 37, 39). Gnathos symmetrical, central element broadly rounded, anterior apodemes not evident. Valva length 275-295 μm, broad, margins in basal half approximately parallel sided, tip slightly curved, pointed; transverse bar of transtilla approximately twice as long as sublateral process. Aedeagus 350-435 μm long, with long, terminally fringed, ventral carina and a dorsal lobe at right side, with serrate margin. Vesica with one long, curved, pointed cornutus (155-190 μm), a short conical (65-100 μm), a long irregular cornutus, seeming composed of several cornuti and almost hidden amongst the long needle-like cornuti; many small cornuti present. Juxta fig. 40.



Figs. 37-43. *Trifurcula puplesisi*, male genitalia. – 37, Capsule, valva outlined, slide 2761; 38, Valva, dorsal aspect, slide 2761; 39, Slightly different uncus of holotype, slide 2760; 40, Juxta, slide 2761; 41, Cornuti, dorsal aspect, slightly squashed, slide BM 25634; 42, Aedeagus, ventral aspect, part of cornuti, protruding from aedeagal tube also shown, slide 2761; 43, Aedeagus, lateral aspect, holotype, slide 2760. Scale 0.1 mm.

Fig. 44. Distribution of *Trifurcula puplesisi*, mapped on 50 × 50 km UTM squares.

Female genitalia (figs. 89, 95). – Terminal segments relatively broad; T8 with about 9-11 setae and several spines, broad anal papillae with 28-37 setae. Signa long, 525-630 μm. Ductus spermathecae with 3¼ coils.

Diagnosis

Males resemble other species without black scaling and simple yellow patch, in particular *austriaca*, which is smaller and has fewer antennal segments and *luteola*, which is usually much paler and has a more triangular valva. Female recognized by large number of setae on anal papillae and relatively long signa.

Biology

Hostplant and immature stages unknown. The adults were taken in steppe area, almost desert, in May, June and July.

Distribution (fig. 44)

Caspian Sea area, just inside Europe and southern Turkmenia.

Remarks

The specimen from the Christoph collection, labelled 'Sarepta' is tentatively assigned to this species, but excluded from the type series, since it is much paler and shows slight differences in genitalia, such as the form of the juxta.

The paratype from the Zeller/Walsingham collection, also collected by Christoph, has only been labelled with: '10/7' [black ink on green, handwriting] / '473' [round label, black ink on green, handwriting] / 'Christoph' [black ink on white, handwriting], and the usual Walsingham collection labels with no. 101450. The locality has been traced from correspondence from Christoph to Zeller, now present in the Entomology Library, BMNH. Only in one letter with lists of specimens, sent by Christoph to Zeller for identification, a number as high as '473' could be found. It is assumed that this refers to the specimen in question. The letter is dated 'Sarepta Den 12 März 1873' and bears the number 382. Under the number '473' in the list 'Determinanda' is written 'Derbent, Nacht b Ligt'. It is also assumed that the specimen was collected in July 1872, since the letter apparently refers to the most recent sending, collected in the previous year. Note further that the locality Derbent, a town on the Caspian Sea, is sometimes confused in lepidopteran literature with the locality 'Derbend' in Iran, North of Teheran, where recently various lepidopterists collected. Christoph often travelled via Derbent, when he crossed the Caspian Sea towards Turkmenistan or northern Iran (Christoph 1877), and as far as I know never collected in the Iranese 'Derbend'.

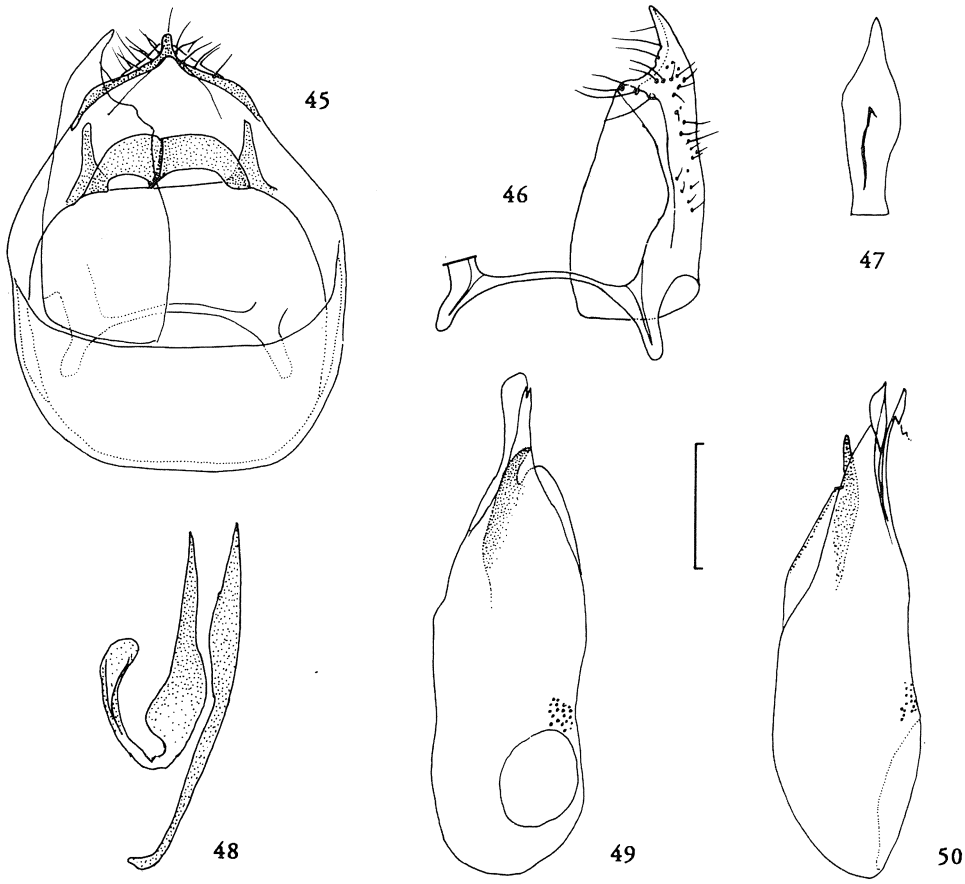
Etymology

A noun in genitive, named in honour of its collector, Dr. Rimantas Puplesis, a Lithuanian specialist of central and east Asian Nepticulidae, who kindly trusted me his material for description.

4. **Trifurcula coronillae** sp. n.

(figs. 3, 10, 18, 19, 29, 45-50, 90, 96, 101, 106)

Type material. – Holotype ♂: Spain, Sierra Blanca, 6 km N Marbella, El Mirador (Málaga), 800 m, UTM: 30S UF34, 5-9.ii.1984, *Coronilla juncea*, from stem-mines, e.l. 13.vii.1984, EvN no. 84046, E. J. van Nieukerken, Genitalia slide EvN 2592 (RMNH). – Paratypes: 15 ♂, 11 ♀, 30 larvae. Spain: 4 ♂, 4 ♀, 7 larvae, data as holotype, e.l. 31.v.1984- 25.viii.1984, (RMNH); 13 larvae, 5 km S Istán, road to Embalse de la Concepción (Málaga), 150 m, UTM: 30S UF2545, 17.i.1988, *Coronilla juncea*, stem-mines, EvN no. 88057, van Nieukerken & Richter (RMNH); 4 ♂, El Saler (Valencia), UTM: 30S YJ26, 22.iv.1981, C. Gielis (RMNH, coll. Gielis); 2 larvae, Rodalquilar, 5 km SW Las Negras (Sierra del Cabo de Gata) (Almería), 120 m, UTM: 30S WF8579, 8.i.1988, *Coronilla juncea*, stem-



Figs. 45-50. *Trifurcula coronillae*, male genitalia holotype, slide 2592 (except 48, 49). – 45, Capsule, valva outlined; 46, Valva, dorsal aspect; 47, Juxta; 48, Large cornuti, separately drawn, slide 2593; 49, Aedeagus, ventral aspect, slide 1883; 50, Aedeagus, lateral aspect. Scale 0.1 mm.

mines, EvN no. 88005, van Nieukerken & Richter (RMNH); 2 ♂, 4 ♀, Sierra Blanca, El Garopala, 3 km NNW Ojén (Málaga), 670 m, UTM: 30S UF3250, 15.i.1988, *Coronilla juncea*, stem-mines, e.l. 6.vi.1988-22.viii.1988, EvN no. 88051, van Nieukerken & Richter (RMNH); 4 ♂, 3 ♀, 8 larvae, Sierra Blanca, Puerto de Marbella (El Mirador), 3 km W Ojén (Málaga), 900 m, UTM: 30S UF3048, *Coronilla juncea*, 15.i.1988, e.l. 30.v.1988-30.vii.1988, EvN no. 88047, van Nieukerken & Richter (RMNH); 1 ♂, road to Istan (Málaga), 400 m, UTM: 30S UF24, 25.vi.1975, E. Traugott-Olsen (ZMUC).

Excluded from type series: 2 ♂ (abdomina lost), data as holotype, e.l. 1.viii.1984 (RMNH).

Description

Male (fig. 3). – Forewing length 2.6-3.2 mm (2.88 ± 0.17, 18), wingspan 5.6-6.7 mm. Head: frontal tuft yellowish orange to orange, collar slightly paler to almost white. Antenna with 41-48 segments (44.0 ± 2.0, 12); scape white, often with scattered brown scales. Forewing and thorax covered with brown tipped scales, distal ¼ dark, edge darker, giving the wing a greyish brown impression; white scales sometimes exposed at dorsum; terminal cilia yellowish white, cilia line indistinct. Underside of forewing with large patch, extending from base to ½, more or less distinctly divided into three areas with different colour: basally deep yellow, middle part buff yellow, terminally olive brown (figs. 10, 18, 19). Hindwing greyish, basal area with white lamellar scales.

Female. – Forewing length 2.4-3.2 mm (2.91 ± 0.23, 11), wingspan 5.4-6.4 mm. Antenna with 35-42 segments (39.8 ± 2.2, 10).

Male genitalia (figs. 45-50) – Capsule length 340-355 μm. Vinculum anteriorly truncate. Uncus with medial process truncate. Gnathos asymmetrical, with a longitudinal keel, slightly left of middle on

ventral surface, posterior margin rounded. Valva length 250-270 μm, with almost parallel margins, suddenly narrowed in terminal quarter towards pointed tip, transverse bar of transtilla twice as long as sublateral processes or longer. Aedeagus 360-390 μm long, with ventral carina bifurcate; aedeagal tube with spatulate tip ventrally, dorsal lobe not pronounced at right side, but with strong medial spine-like process, curved towards right side, which in normal preparations is almost inseparable from the large cornuti: there appear to be three in stead of two. Vesica with two large spine-like cornuti (one somewhat irregular) and a conical cornutus; long needle-like and many smaller cornuti present. Juxta fig. 47.

Female genitalia (figs. 90, 96). Terminal segments broad and rounded; T8 with 6-8 setae and several scales; anal papillae with 24-30 setae. Ductus spermathecae with 3¼ to 3½ coils. Signa 420-470 μm (ventral) and 460-520 μm (dorsal) long.

Final instar larva (fig. 101). Yellow, elongate. Headcapsule 325-355 μm long (341 ± 10.7, 5), 1.06-1.13 (1.09 ± 0.02, 5) × as long as wide. Spinosity: prothorax ventrally with narrow band posteriorly, meso- and metathorax ventrally with a band along anterior margin and very few spines on calli. Abdominal segments 1-9 with sparse spinosity ventrally and laterally up to the spiracles, spines near anterior margins smaller; segment 10 with small group of spines anterior of setae.

Diagnosis

Male easily recognized by the androconial patch with three different colours and absence of black scaling on hindwing. Male genitalia unique by shape of gnathos and cornutus-like process on aedeagus. Female very similar to *josefklimeschi*, but separated by the blunt abdominal point, versus the slightly pointed condition in *josefklimeschi*. Females of *victoris* are paler, and have less antennal segments, females of *subnitidella* are darker and have also less antennal segments.

Biology

Hostplant. – *Coronilla juncea* L., a shrub up to 1 m, with rush-like stems, slightly resembling a broom.

Life history. – The egg is deposited on an internodium of the smooth rush-like stem of the hostplant, and is conspicuous. The larva makes a very conspicuous gallery mine in the green bark, in which the living larva can easily been seen (fig. 106). The mine often starts contorting, frequently encircling the stem; the larva often feeds downward first, but later changes feeding direction one or more times, the mine usually ends in upwards direction. The mine is filled with greenish brown frass. There are often numerous mines in a single stem. The brown cocoon is made in soil or on leaf litter. Larvae have been collected in January and February, but many mines were already vacated in that period, so that larvae probably start mining in autumn. Adults emerged over a very long period, from May to August. The only adults taken in the field were collected in April and June. The species is most likely univoltine.

Distribution (fig. 29)

Along mediterranean coast of Spain, to be expected elsewhere with its host, which occurs from West Yugoslavia to Portugal (Heywood & Ball 1968).

Etymology

A noun in genitive case, from *Coronilla*, the generic name of the hostplant.

5. Trifurcula (Trifurcula) victoris sp. n.
(figs. 4, 51-56, 76, 91, 97, 102)

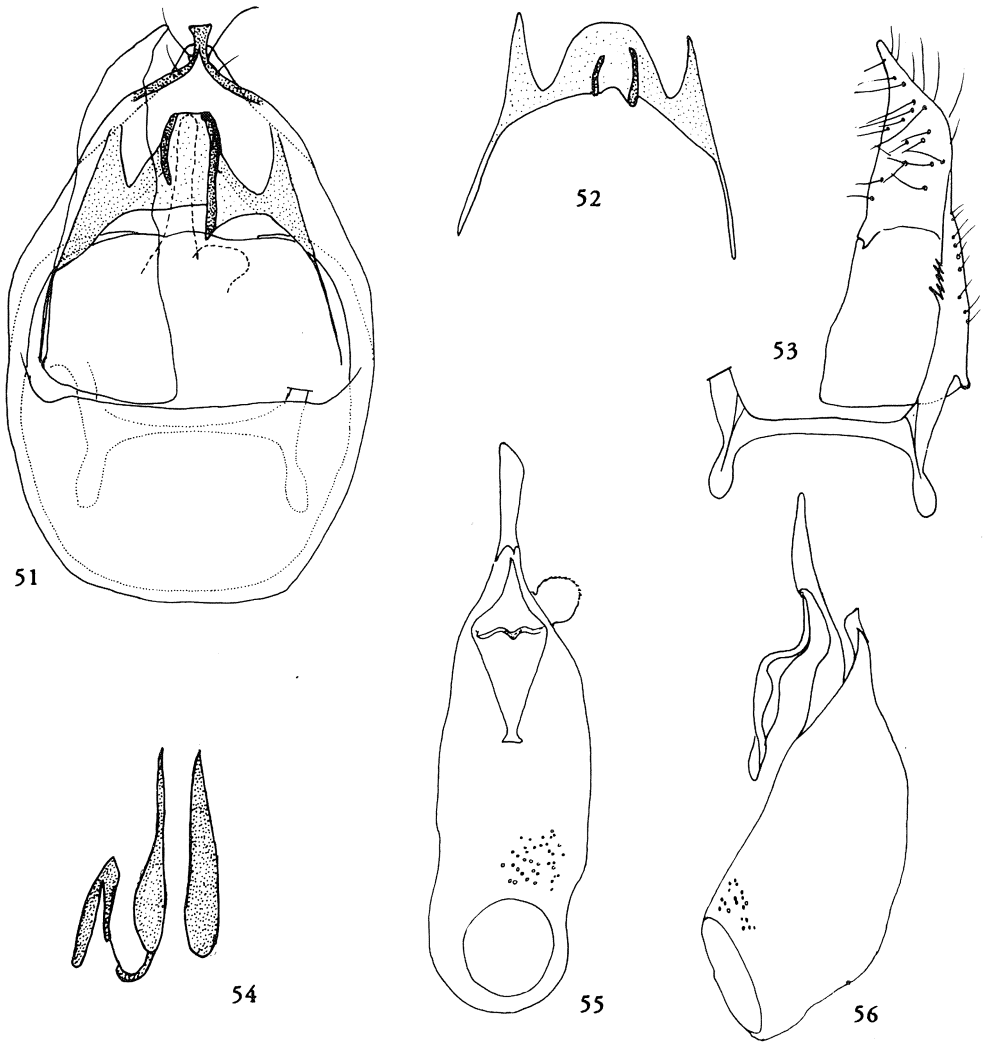
Type material. – Holotype ♂: Spain: El Pozo de los Frailes, 3 km N San José (Almería), UTM: 30S WF7972, 8.i.1988, *Anthyllis cytisoides*, stem-mines, e.l. 4.iii.1989, EvN no. 88003, van Nieukerken & Richter (RMNH). – Paratypes: 2 ♂, 6 ♀, 4 larvae. Spain: 2 ♂, 6 ♀, 3 larvae, same data as holotype, e.l. 29.ii.1989-30.v.1989 (RMNH); 1 larva, 3 km NE Níjar, Cerro de Movillas (Almería), 400 m, UTM: 30S WF7393, 9.i.1988, *Anthyllis cytisoides*, stem-mines, EvN no. 88007, van Nieukerken & Richter (RMNH).

Description

Male (fig. 4). – Forewing length 3.0-3.5 mm, wingspan 6.5-7.2 mm. Head: frontal tuft yellowish-orange to ferruginous, collar paler, yellowish white. Antenna with 40-42 segments; scape white, with some darker scales, flagellum brown. Forewing and thorax relatively pale, appearing pale brown-grey: scales with distalmost tip (margin only) brown, few white scales at tornus; terminal cilia white beyond more or less distinct cilia-line. Underside of forewing with deep yellow patch of about ¼ forewing length. Hindwing grey, humeral lobe well developed, on upperside with yellow scales along margin, black scaling absent.

Female. – Forewing length 2.9-3.3 mm (3.04 ± 0.12, 6), wingspan 6.5-7 mm. Antenna with 32-35 segments (33.5 ± 1.3, 4). Ovipositor with short point.

Male genitalia (figs. 51-56) – Capsule length 425-440 μm. Vinculum anteriorly truncate or rounded. Uncus with medial process strongly widened, truncate. Gnathos very asymmetrical, variable, always with two longitudinal keels of different length, leaving ventrally excavation in which aedeagal tip fits (dashed in fig. 51), anterior apodemes present. Valva length 285-290 μm, approximately triangular, dorsally with a row of 4-5 spines along continuation of lateral arm of transtilla, transverse bar



Figs. 51-56. *Trifurcula victoris*, male genitalia. – 51, Capsule, valva and tip of aedeagus outlined, slide 3064; 52, Gnathos of holotype, showing variation, slide 2743; 53, Valva, dorsal aspect, slide 3064; 54, Large cornuti, separately drawn, slide 3064; 55, Aedeagus and juxta, ventral aspect, slide 3064; 56, Aedeagus and juxta, lateral aspect, holotype, slide 2743. Scale 0.1 mm.

of transtilla about twice as long as sublateral processes. Aedeagus 395-435 μm long, with ventral carina spatulate, dorsal lobe at right side conspicuous, margin serrate; vesica with two large and very similar cornuti, one joined to smaller cone-shaped cornutus; group of spine-like cornuti very much reduced in size and number, only a few present at basis of both large cornuti; numerous small cornuti present. Juxta fig. 55.

Female genitalia (figs. 91, 97). – Terminal segments forming slightly pointed abdominal tip; T8 with 8-10 setae and some scales; anal papillae with 21-29 setae. Ductus spermathecae with 4 coils. Signa 465-530 μm long.

Final instar larva (fig. 102). – Yellow, elongate. Head capsule 385-435 μm, 1.03-1.05 × as long as wide. Spinosity: prothorax ventrally with narrow band of minute spines posteriorly, meso- and metathorax ventrally without spines. Abdominal segments 2-9 with microspines ventrally, hardly visible; segment 10 with small group of spines anterior of setae.

Diagnosis

Male recognized by uniformly coloured yellow patch, absence of black scaling and relatively pale forewings. *T. luteola* is paler, with yellow scale tips instead of brown or grey. Male genitalia characterized by asymmetrical gnathos with two keels and reduction of spine-like cornuti. Female may be confused with *coronillae*, which is darker; *victoris* also has more pointed anal papillae.

Biology

Hostplant. – *Anthyllis cytisoides* L., a broom-like leafy shrub of 0.5-1.5 m, with velvety hairy stems and leaves.

Life-history. – Egg deposited on stem. The larva makes a long gallery in the bark, which is difficult to see, because of the dense indumentum of the stem. It could best be seen because of the swelling and the slight discoloration, especially in the case of old mines. Larva not visible in its mine. The mines were actually collected on stems, heavily infested by gall-forming coccids. Larvae collected in January, adults emerged from February to May. One female emerged from leaf-litter, which had been collected from underneath the hostplants.

Distribution (fig. 76)

Only known from the extremely dry region in the southeast part of the province of Almería, Spain. Despite search in other sites along the Spanish southcoast, where the host is common, no more mines could be found.

Etymology

A noun in genitive case, from latin *victor*, named after my son Victor Alexander.

6. Trifurcula (Trifurcula) subnitidella (Duponchel)

(figs. 5, 9, 11-17, 57, 61-68, 92, 98, 103, 107)

Elachista subnitidella Duponchel, [1843]: 326, pl. 77: 8. Lectotype ♂ [designated by van Nieukerken & Johansson 1987: 471]: [Austria, Vienna region], Duponchel coll., Genitalia slide EvN 2522 (MNHN) [examined].

Trifurcula griseella Wolff, 1957: 21. Holotype ♂: Denmark, Asserbo, 30.v.1954, N. Wolff, genitalia slide NW 1797 (ZMUC) [Synonymized by van Nieukerken & Johansson 1987: 471] [examined].

Nepticula subnitidella (Duponchel) Zeller 1848: 305 [redescription, mistaken identity], Joannis 1915: 127 [identity], Rebel 1901: 221 [catalogue], Meess 1910: 474 [listed].

Trifurcula subnitidella (Duponchel) van Nieukerken & Johansson 1987: 471 [selection lectotype], 1990: 273 [description, NW Europe].

Trifurcula griseella Wolff; Bradley 1962: 174, fig. 4 [Ireland, male genitalia], Bjørn & Pallesen 1971: 111 [Denmark], Bradley et al. 1972: 3 [Britain], Svensson 1974: 171 [Sweden], Emmet 1975: 39-42 [England, Scotland], Karsholt & Nielsen 1976: 18 [Denmark], Emmet 1976: 209 [description, British Isles], Svensson 1980: 85 [Sweden], Buhl et al. 1983: 120 [Denmark], Svensson 1983: 65 [Sweden], Kasy 1983: 5 [Austria], Buhl et al. 1984: 3 [Denmark], Svensson 1985: 81 [Sweden], Kasy 1985: 5 [Austria], Karsholt 1985: 45 [catalogue Denmark], van Nieukerken 1986a: 16 [checklist], Bradley & Fletcher 1986: 2 [list], Pröse 1987: 49 [West Germany: Bavaria], Svensson 1987: 3-3 [catalogue Sweden], Buhl et al. 1987: 100 [Denmark], Buhl et al., 1988: 101 [Denmark].

Description

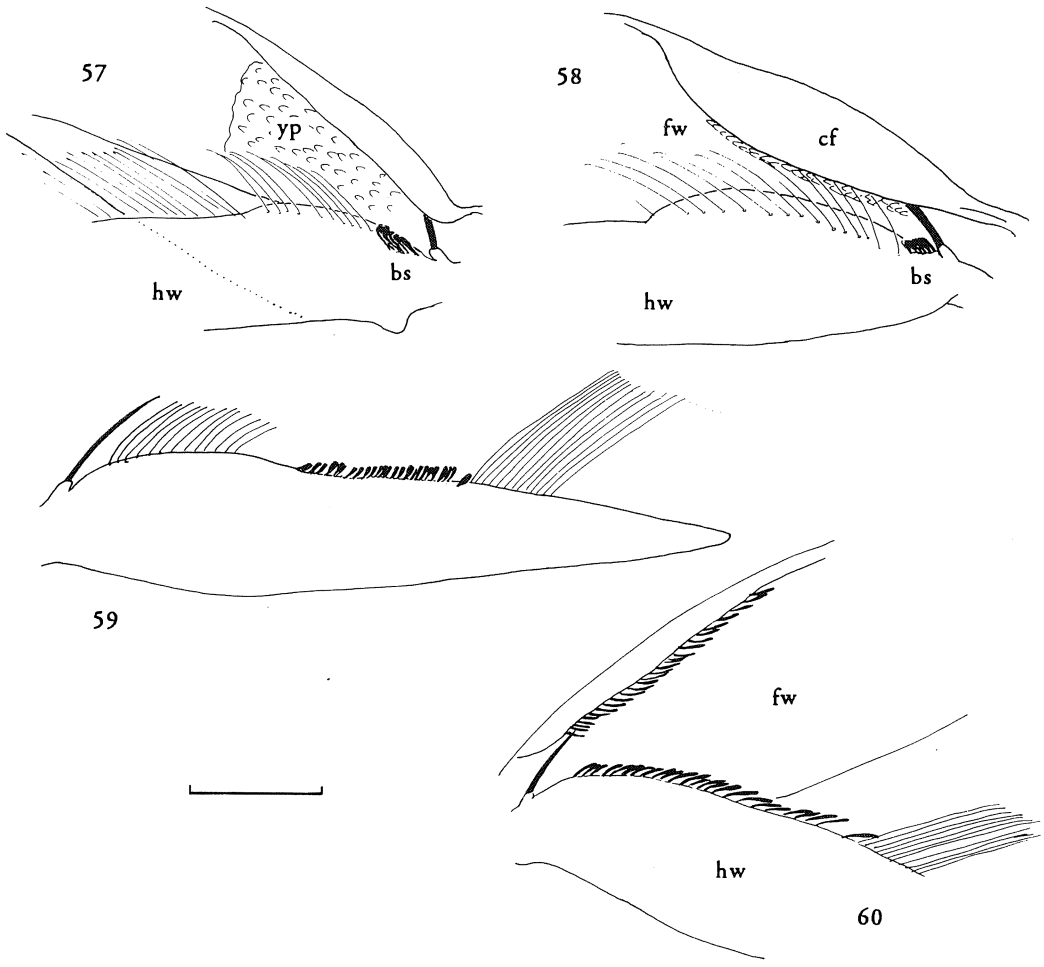
Male (fig. 5). – Forewing length 2.0-2.6 mm (2.37 ± 0.17, 44), wingspan 4.2-5.8 mm. Head: frontal tuft yellow-ochre to fuscous, variable; collar similar. Antenna with 31-36 segments (33.4 ± 1.3, 40); scape white, sometimes with few brown scales. Forewing dark greyish-brown to fuscous, slightly irrorated by dark tipped scales, no white spots present; underside with distinct basal patch of deep yellow scales near costa reaching to ¼ (figs. 9, 11-13). Hindwing: grey, underside along costa directly behind frenulum with a distinct short row of black lamellar scales (figs. 14, 15, 57). Abdomen dark grey, with yellowish grey tufts.

Female. – Forewing length 2.0-2.4 mm (2.22 ± 0.16, 9), wingspan 4.4-5.4 mm. Antenna with 27-32 segments (30.4 ± 1.7, 9).

Male genitalia (figs. 61-67). – Capsule length 330-390 μm (349.6 ± 14.8, 15). Vinculum anteriorly rounded. Uncus slightly widened, truncate at tip. Gnathos asymmetrical, central element with an anteriorly curved keel, ending in a pointed process at right side; lateral arms with long and narrow anterior apodemes. Valva length 250-289 μm (264.2 ± 9.0, 15), basally with almost parallel margins, narrowed in middle towards pointed tip. Aedeagus 330-365 μm (344.0 ± 14.0, 15), with ventral carina bifid; aedeagal tube with spatulate tip, dorsal lobe in middle, or slightly on right side, with serrate margin. Vesica with one very long straight, or slightly curved cornutus, with a conical cornutus joined to its basis, and a pointed cornutus with serrations; less then 10 spine-like cornuti and many small cornuti present. Juxta fig. 62.

Female genitalia (figs. 92, 98). – Terminal segments rather broad; T8 with 3-6 setae and some scales; anal papillae with 11-20 setae each. Ductus spermathecae with 3¼ convolutions. Signa 300-355 μm (dorsal) and 350-365 μm (ventral) long.

Final instar larva (fig. 103). – Long and slender, deep yellow. Head capsule 325-345 μm, 1.13-1.16 × as long as wide, distinctly narrower than in other three described species. Spinosity: prothorax ventrally with narrow band posteriorly, meso- and metathorax with spines between D1 seta and calli. Abdominal segments 1-9 with sparse spinosity ventrally and laterally up to the spiracles, spines near anterior margins smaller; segment 10 with small group of spines anterior of setae.



Figs. 57-60. *Trifurcula* males, forewing and hindwing undersides, showing position of black scales, yellow patch and costal fold. – 57, *T. subnitidella*, Netherlands, Katwijk; 58, *T. josefklimeschi*, paratype, Austria, Hundsheimer Berg; 59, *T. iberica*, hindwing only, paratype, Spain, Prullans; 60, *T. silviae*, paratype, France, Ceillac. Scale 0.3 mm.

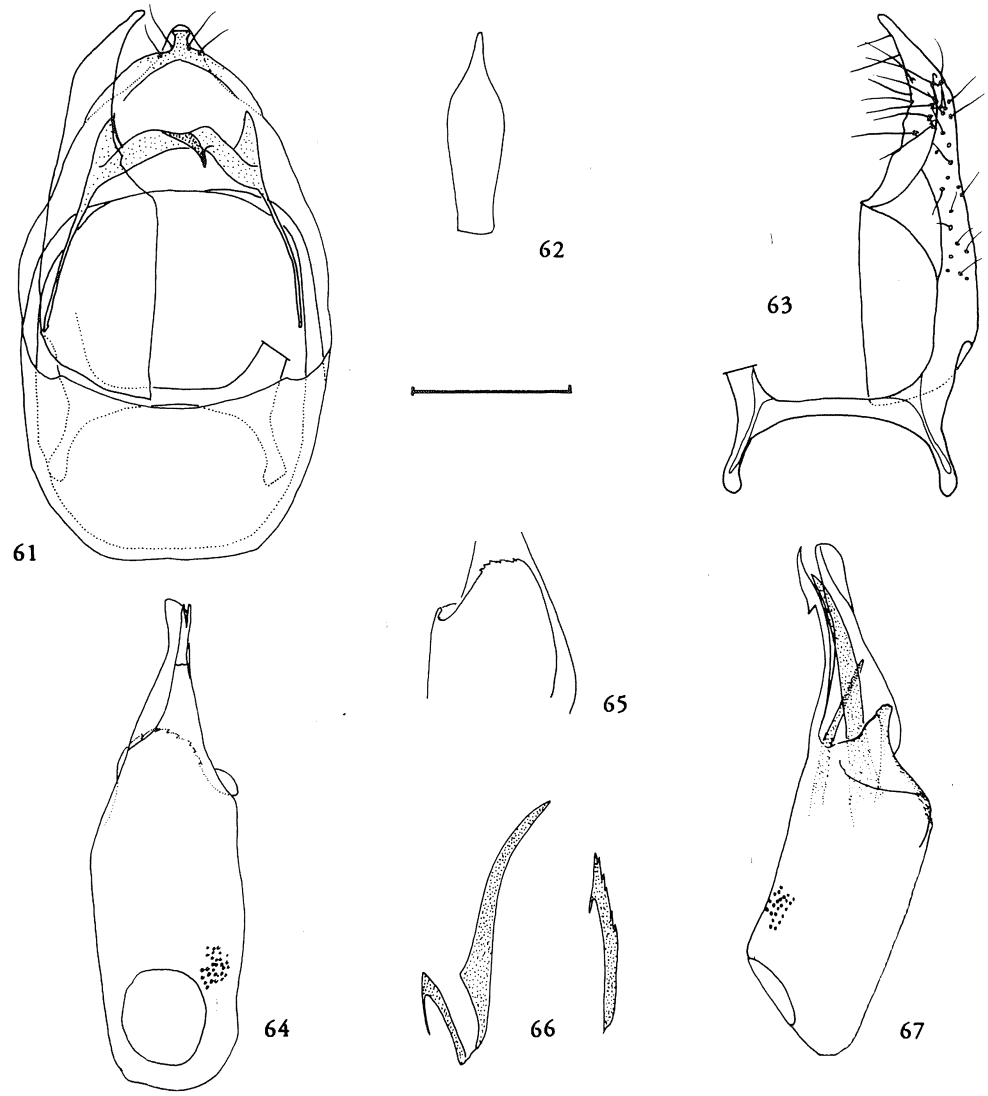
Diagnosis

Male *subnitidella* differs from other species in the group by the combination of a simple yellow patch and a group of black scales just behind frenulum; further it is one of the smaller and darker species, with less antennal segments than most other species (36 maximum). The male genitalia are well characterized by the gnathos process. Females are smaller and darker than the other described females, and have less antennal segments.

Biology

Host plant. – *Lotus corniculatus* L., a common perennial herb of grasslands all over Europe, possibly also on other *Lotus* species.

Life history. – The egg is conspicuous and deposited on the stem of the host, usually at the base of a leaf-stalk (fig. 107), frequently near the stem base. The mine is a long gallery in the bark of the stem (fig. 107): the larva is first mining down for 0.5-2 cm, then going up the stem in a rather straight line, or partly encircling the stem, occasionally going down again in the last part of the mine. The mine may reach a total length of 6 to 9 cm. The mine is at first narrow, reddish brown, with straight edges, but later becomes as wide as the stem, with irregular margins, becoming silvery white in fresh mines. Frass deposited in midline, brown, not always well visible. Larva well visible in mine, appearing as a slight swelling. The stems of the host are not killed by the mining activity. The larva quits the mine through a semicircular slit, and spins a cocoon in the soil or on leaf-liter.



Figs. 61-67, *Trifurcula subnitidella*, male genitalia, slide 2501 (slide 2745 for fig. 62). – 61, Capsule, valva outlined; 62, Juxta; 63, Valva, dorsal aspect; 64, Aedeagus, ventral aspect; 65, Idem, dorsal lobe, dorsal aspect; 66, Large cornuti, separately drawn; 67, Aedeagus, lateral aspect. Scale 0.1 mm.

Larvae have been taken in September and October, adults fly from May (March in Tunisia) to early September. Reared adults emerged in May. Voltinism not yet clear from these data, clear peaks in flight are not apparent. More data from single localities are needed, and bivoltinism can only be proved by finding larvae and rearing in early summer.

In northern Europe *T. subnitidella* is almost exclusively found on limestone grasslands (downland) and coastal dunes, in southern Europe it is found in many habitat types. The species might be vulnerable to habitat loss in more northern parts of its occurrence.

Distribution (fig. 68)

Widespread in Europe, northward to 60° N, southward to the northern border of the Sahara in Tunisia and eastward to the Crimea and Asia minor. Not yet recorded from Norway, Belgium, Luxembourg, Switzerland, Poland, Hungary, Albania and Portugal, nor from any of the large mediterranean islands. The species is here for the first time in detail recorded from Finland, The Netherlands, Germany, Czechoslovakia, France, Spain, Italy, Rumania, Bulgaria, Yugoslavia, Greece, Turkey, Soviet Union (Estonia and Ukraine) and Tunisia.

Remarks

T. subnitidella is slightly variable in colour, specimens from northern Europe tend to be darker than those from southern Europe.

The figure of the male genitalia in Wolff's description of *T. griseella* (1957), has been published as mirror image.

In North America, a striking case of convergence has been described by Wagner (1987): his species *Microcalyptris lotella* was reared from very similar stem-mines in *Lotus*, and, moreover as adult male it has a yellowish patch on the forewing underside, very similar to that of *subnitidella*. Also *lotella* has been found in a habitat that in Europe could harbour *subnitidella*: coastal dunes. Yet *Microcalyptris* Braun (synonymized with *Acalyptris* Meyrick by van Nieukerken 1986a) is a completely different genus, only distantly related to *Trifurcula*.

Material examined. - 115 ♂, 14 ♀, 5 larvae (including type-material cited above). - Austria: 1 ♂ [genitalia slide MV13111 only], Apetlon, Seewinkel (Burgenland), UTM: 33T XN38, 9.viii.1963, F. Kasy (NHMW); 1 ♂, Fürbachwiesen, East of Gramatneusiedl (Niederöst.), UTM: 33U XP11, 23.vii.1981, F. Kasy (NHMW); 1 ♂, Hundsheimer Berg S. (Niederöst.), UTM: 33U XP43, 8.vii.1980, F. Kasy (NHMW); 1 ♂ [photo genitalia slide], Linz, surroundings (Oberöst.), UTM: 33U VP44, 18.vii.1934, J. Klimesch (coll. Klimesch). - Bulgaria: 1 ♂, Nesebur (Nessebar), UTM: 35T NH52, 23.viii-4.ix.1962, J. Soffner (DEIC). - Czechoslovakia: 2 ♂, Detkovice (Moravia), UTM: 33U XQ57, 2.vi and 4.vii.1989, A. Laštúvka (coll. Laštúvka). - Denmark: 1 ♀, Asserbo, UTM: 33V UC11, 10.vi.1964, N. L. Wolff (ZMUC); 6 ♂, Laesö, Bovet (NEJ), UTM: 33V PJ25, 8, 9 and 13.vii.1982, 30.vi and 8.vii.1983, O. Karsholt (ZMUC); 9 ♂, 5 ♀, Laesö, Höjsandet (NEJ), UTM: 33V PJ25, 1 and 6.vii.1983 O. Karsholt (ZMUC); 4 ♂, Laesö, Nordmarken (NEJ), UTM: 33V PJ25, 5, 6 and 9.vii.1983, O. Karsholt (ZMUC). - Finland: 2 ♂, Virolahti (EK), UTM: 35V NH30, 27.vi.1989 [netted at seashore over *Lotus corniculatus*], J. R. Kaitila (RMNH). - France: 1 ♂, Cannes (Alp. Mar.), UTM: 32T LP42, iv.1881, Walsingham (BMNH); 1 ♂, Col de Soubeyrand (Drôme), 994 m, UTM: 31T FK81, 2.viii.1986, H. W. van der Wolf (coll. van der Wolf); 1 ♂, La Veuve, Digne, UTM: 32T KP78, 12.viii.1901, Chrétien (MNHN); 1 ♂, Nesp. [probably Nespouls, near St. Pons] (Hérault), UTM: 31T DJ81, 2.viii.1904, (MNHN). - Germany (West): 2 ♂, Bamberg: Tütschengereuth (Bayern), UTM: 32U PA22, 4.viii.1978, G. Derra (coll. Derra). - Germany (East): 2 ♂, Blankenburg, Muschelkalk , UTM: 32U PB51, 29.v.1965, 10.viii.1989, H. Steuer (coll. Steuer). - Great Britain: 1 ♂, Mickleham (Surrey), UTM: 30U XB88, 23.vi.1856, grass, H. T. Stainton (BMNH); 1 ♂, Mickleham, Headley Lane (Surrey), UTM: 30U XB88, 10.vi.1857, (BMNH). - Greece: 1 ♂, Kavisos (Evro), 100 m, UTM: 35T MF, 22-23.viii.1985, A. Moberg (NHRS). - Italy: 2 ♂, Almese, surroundings (Torino), 350 m, UTM: 32T LQ79, 16 and 20.v.1979, U. Parenti (RMNH, coll. Parenti); 1 ♂, Asti, Boschi di Valmanera, 124 m, UTM: 32T MQ37, 1.v.1970, G. Baldizzone (GBA); 2 ♂, Asti, Valmanera (Asti), UTM: 32T MQ37, 28.iv.1968, 26.viii.1968, G. Baldizzone (RMNH, coll. Passerin-d'Entrèves); 1 ♂, Baia Domizia (Caserte), UTM: 33T UF55+, 25.vii.1972, R. Johansson (coll. Johansson); 1 ♂, Cardona (Alessandria), 300 m, UTM: 32T MQ39, 19.v.1975, G. Baldizzone (GBA); 2 ♂, Lucotena (Firenze), 500 m, UTM: 32T PP93, 11.viii.1982, J. Kuchlein (RMNH, coll. Kuchlein); 1 ♂, Monti Aurunci, 5 km N Itri (Latina), 600 m, UTM: 33T UF77, 24-30.v.1969, R. Johansson (coll. Johansson); 1 ♂, Poggio di Casasco (Alessandria), 300 m, UTM: 32T NQ06, 3.vi.1978, G. Baldizzone (GBA); 2 ♂, Val Susa (Piemonte), Villardora (Torino), 500 m, UTM: 32T LQ79, 26.v.1983, G. Bassi (coll. Bassi). - Netherlands: 1 ♂, Katwijk, 2 km N: dunes (Zuid-Holland), UTM: 31U ET9686, 16.x.1988, *Lotus corniculatus*, stem-mines, e.l. 21.v.1989, EvN no. 88175, van Nieukerken & Richter (RMNH); 1 ♂, Kunrade, Kunderberg (Limburg), UTM: 31U GS0739, 02.vii.1983, G. R. Langohr (coll. Langohr); 2 ♂, 2 ♀, 3 larvae, Kunrade: Kunderberg W. (Limburg), UTM: 31U GS0739, 5.x.1988, *Lotus corniculatus*, stem-mines, e.l. 10.v.1989-18.v.1989, EvN no. 88156, van Nieukerken & Richter (RMNH); 1 ♂, St. Pietersberg, Cannerbos (Limburg), UTM: 31U FS8733, 18-19.vii.1950, [22.3-0.3 hrs] (RMNH); 1 ♂, St. Pietersberg, Zonneberg (Limburg), UTM: 31U FS8934, 20.vii.1950, [21-22 hrs] (RMNH); 1 ♂, 1 ♀, 2 larvae, Wijlre, 1 km SE: railway banks (Limburg), UTM: 31U GS0534, 5.x.1988, *Lotus corniculatus*, stem-mines, e.l. 11.v.1989-15.v.1989, EvN no. 88162, van Nieukerken & Richter (RMNH); 1 ♂, 1 ♀, Vrakelberg, 2 km E. of Wijlre, UTM: 31U GS0537, 22.ix.1989, *Lotus corniculatus*, stem-mines, e.l. 1-5.v.1990, E. J. van Nieukerken (RMNH); mines, Noord-Bakkum, 3 km N Castricum (Noord-Holland), dune meadows, UTM 31U FU1226, 6.x.1989, *Lotus corniculatus*, E. J. van Nieukerken. - Rumania: 1 ♂, Gusterita near Sibiu (Hammersdorf near Hermannstadt), UTM: 35T KL87, 12.v.1920, (NHMW); 1 ♂, Sibiu (Hermannstadt, Pralb.), UTM: 35T KL87, 18.v.1922 (NHMW). - Spain: 1 ♂, Beuda (Pyr. orient.), UTM: 31T DG77, 14.vii.1967, E. Arenberger (LNKD); 1 ♂, Biescas (Huesca), UTM: 30T YN12, 1.viii.1989, C. Gielis (coll. Gielis); 3 ♂, Puerto de Mora (Granada), 1350 m, UTM: 30S VG52, 22.vii.1986, C. Gielis (RMNH, coll. Gielis); 1 ♂, San Miguel de Valero N, 3 km S Linares de Riofrio (Salamanca), 850 m, UTM: 30T TK59, 2.viii.1986, at light ML, Quercus pyrenaica forest & heathland, EvN no. 86091, E.J. v.Nieukerken & S.Richter (RMNH); 1 ♂, Sierra de Marbella, El Mirandor (Málaga), 700 m, UTM: 30S UF34, 21.vii.1981, E. Traugott-Olsen (ETO); 1 ♂, road Baza-Benamaurel, 15 km from Baza (Granada), UTM: 30S WG25, 16.vii.1987, Baldizzone & Traugott-Olsen (GBA); 1 ♂, road to (Camino de) Ojen (Málaga), 150 m, UTM: 30S UF34, 25.vi.1983, E. Traugott-Olsen (ETO). - Sweden: 2 ♂, 1 ♀, Byrum Sandvik (Öland), UTM: 33V XD1742, 20.vi.1978, B. Bengtsson (coll. Johansson, ZMUC); 1 ♀ [slide only], Kinnekulle (Vg), UTM: 33V VE09, 29-30.v.1968, I. Svensson (coll. Svensson); 1 ♂, Klagshamn (Sk), UTM: 33V UB65, 7.viii.1982, R. Johansson (coll.Johansson). - Soviet Union: 1 ♂, Dobroe, Krasnolesje [near Simferopol] (Krim, Ukraine), UTM: 36T XQ06, 10.v.1982, Zaguljaev (ZMAS); 1 ♂, Rakvere (Raustfer) [near Tallinn] (Estonia), UTM: 35V MF68, 8.vi.1890 (ZMAS); 1 ♂, Sevastopol, Inkerman (Krim, Ukraine), UTM: 36T WQ44, V. Pliginski (ZMAS). - Tunisia: 1 ♂, Nefta, UTM: 32S LC94, 14-16.iii.1986, Zool. Mus. Copenh. (ZMUC). - Turkey: 2 ♂, Ankara, 10 km NW Kizilcahaman, 1150-1250 m, UTM: 36T VK68, 6-7.viii.1989, Fibiger & Esser (ZMUC). - Yugoslavia: 1 ♂, Herceg Novi, Igalo, UTM: 34T BN90, 1.v.1938, H. G. Amsel (LNKD); 16 ♂, Krk, Draga Baska (Kroatia), UTM: 33T VK78, 25 and 27.vii.1976, 3.viii.1976, 1.viii.1977, 3.viii.1978, 5.viii.1985, 30.vii.1986, 15.viii.1988, G. Baldizzone (GBA, RMNH); 6

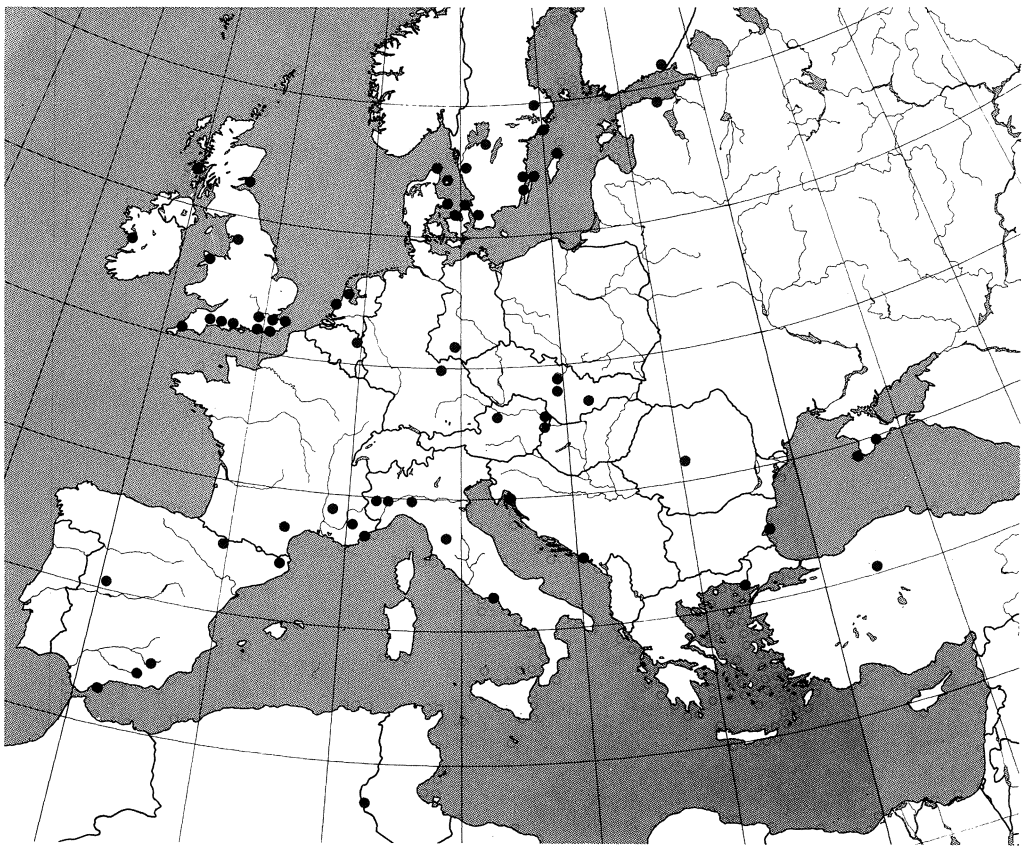


Fig. 68. Distribution of *Trifurcula subnitidella*, mapped on 50 × 50 km UTM squares.

♂, 2 ♀, Krk, Misucaynica (Kroatia), UTM: 33T VK78, 18.viii.1973, 30.vii.1976, 6.viii.1976, 4 and 9.viii.1986, G. Baldizzone (GBA, RMNH); 1 ♂, Krk, Paprata/Vinder (Kroatia), UTM: 33T VK79, 16.viii.1978, G. Baldizzone (GBA); 1 ♂, Krk, Soline (Kroatia), UTM: 33T VK69, 11.viii.1976, G. Baldizzone (GBA); 8 ♂, Krk, road Krk-Vrbnik (Kroatia), UTM: 33T VK78, 2.viii.1987, 23.vii.1988, 3.viii.1988, G. Baldizzone (GBA, RMNH)

Additional records. – Czechoslovakia: Čelechovice (UTM: 33U XQ78), Prostějov Hamry (33U XQ48), Kozárovce (34U CU15) (Z. Laštúvka in litt.). – Denmark: Melby Overdrev (Buhl et al. 1983), Korevle (Buhl et al. 1984), Glatved (32V PH14)(Buhl et al. 1987a), Øster Vrå (32V NJ75)(Buhl et al. 1988). – Great Britain: vice counties 1, 3, 9, 10, 13, 14, 15, 16, 17, 49, 69, 85 and 103 (Emmet in litt. 1987). – Sweden: Hall. Vallda Sandö (PJ7674), Sm. Ryningsnäs (WD5647), Öl. Algutsrum (WC9284), Gtl. Tingstäde (CK5802), Sdm. Ösmo (XF6739), Upl. Fysingen (XG6407) (Svensson in litt. 1987).

7. **Trifurcula josefklimeschi** sp. n.
(figs. 6, 20-22, 58, 69-76, 93, 99, 104, 105)

[*Trifurcula orientella* Klimesch, 1953: 168, 169 partim: all specimens from Austria. Misidentification.]
Trifurcula nov. spec., van Nieukerken in Kasy 1983: 5.

Type material. – Holotype ♂: Italy, M. Bondia, Villa Faraldi, 3.5 km WNW Andora (Imperia), 550 m, UTM: 32T MP2769, 10.iv.1988, *Dorycnium pentaphyllum*, stem-mines, e.l. 20.v.1988, EvN no. 88111, E. J. van Nieukerken (RMNH). – Paratypes: 43 ♂, 13 ♀, 25 larvae. – Austria: 1 ♂, Deutsch Altenburg, Pfaffenberg (Niederöst.), UTM: 33U XP43, 24.viii.1935, [Preissecker] (NHMW) [paralectotype *orientella* Klimesch]; 8 ♂, Hundsheimer Berg (Niederöst.), UTM: 33U XP43, 17.viii.1973, 28.vi.1976, 9.vi.1977, 3.vii.1977, 3.ix.1977, 22.v.1979, 12.ix.1979, F. Kasy (NHMW, RMNH); 1 ♂, Marchegg, Oberweiden (Niederöst.), UTM: 33U XP44, 6.ix.1931, [Preissecker] (NHMW) [paralectotype *orientella* Klimesch]; 1 ♂, Mödling, Frauenstein (Niederöst.), UTM: 33U WP92, 26.vi.1902, Preissecker (NHMW)

[paralectotype *orientella* Klimesch]. – Czechoslovakia: 2 ♂, Hrádok n. V. (Slovakia), UTM: 33U YP19, 17.vi.1988, A. Laštúvka; 2 ♂, Zádiel (Slovakia), UTM: 33U DU88, 7.vi.1989, A. Laštúvka (coll. Laštúvka, RMNH). – Greece: 1 ♂, Kardhamili (Messinias), gorge, UTM: 34S FF1084, 18.ii.1990, *Dorycnium hirsutum*, stem-mines, e.l. 15.iv.1990, EvN no. 90063, E. J. van Nieukerken (RMNH). – Italy: 1 ♂, Andora, Testico (Savona), UTM: 32T MP27, 2-5.vii.1983, B. Å. Bengtsson (coll. Bengtsson); 3 ♂, 2 ♀, Conna (Savona), 300 m, UTM: 32T MP27, 10.ix.1977, 1.ix.1978, 22.vi.1979, G. Baldizzone (GBA, RMNH); 4 ♂, 6 ♀, 1 larva, M. Bondia, Villa Faraldi, 3.5 km WNW Andora (Imperia), 550 m, UTM: 32T MP2769, 10.iv.1988, *Dorycnium pentaphyllum*, stem-mines, e.l. 19.v.1988-4.vi.1988, EvN no. 88111, E. J. van Nieukerken (RMNH); 5 ♂, Poggio di Casasco, Val Curone (Al), 300 m, UTM: 32T NQ06, 06.vi.1987, G. Baldizzone (GBA, RMNH). – Spain: 1 ♂, 1 ♀, 6 larvae, 2.5 km SW Beires, along road Beires-Fondón (Almería), 1000 m, UTM: 30S WF1495, 10.i.1988, *Dorycnium pentaphyllum*, stem-mines, e.l. 20.v.1988-26.vi.1988, EvN no. 88017, van Nieukerken & Richter (RMNH); 1 ♂, Collado de Falset (Cataluna), UTM: 30T CF15, 3.vii.1967, E. Arenberger (LNKD); 1 ♂, 2 ♀, 18 larvae, Sierra Blanca, Refugio de Juanar, 3 km NW Ojén (Málaga), 840 m, UTM: 30S UF3149, 15.i.1988, *Dorycnium hirsutum*, stem-mines, e.l. 20.v.1988-8.vi.1988, EvN no. 88048, van Nieukerken & Richter (RMNH); 2 ♀, Sierra de Marbella, El Mirandor (Málaga), 700 m, UTM: 30S UF34, 21.vii.1987, E. Traugott-Olsen (ETO); 2 ♂, road Baza-Benamaurel, 15 km from Baza (Granada), UTM: 30S WG25, 16 and 17.vii.1987, Baldizzone & Traugott-Olsen (GBA). – Soviet Union: 1 ♂, Parkovo, southcoast Crimea (Krim), UTM: 36T WQ(southeast), 26.v.1984, Zaguljaev (ZMAS). – Yugoslavia: 7 ♂, Krk, Draga Baska (Kroatia), UTM: 33T VK78, 27.vii.1976, 28.viii.1978, 15.viii.1988, G. Baldizzone (GBA, RMNH); 1 ♂, Krk, Skrpcici (Kroatia), UTM: 33T VK68, 04.viii.1977, G. Baldizzone (GBA).

Additional material. – Spain: mines, 3 km NE Marbella, road to Ojén (Málaga), 200 m, UTM: 30S UF3244, 15.i.1988, *Dorycnium hirsutum*, EvN no. 88046, van Nieukerken & Richter (RMNH).

Additional records. – Czechoslovakia: Čebovce (UTM: 34U CU63), Jablonov (34U DV83), Kiarov (34U CU83), Hustopeče (33U XQ22), Zaječí, larvae and adults, 1990, leg. A. and Z. Laštúvka (Z. Laštúvka in litt.).

Description

Male (fig. 6). – Forewing length 2.3-3.0 mm (2.57 ± 0.18, 26), wingspan 4.9-6.5 mm. Head: frontal tuft yellowish white to pale yellowish orange, collar paler. Antenna with 37-43 (40.1 ± 2.1, 22) segments; scape white, usually with some brown scales. Forewing and thorax covered with fuscous tipped scales, distal ¼ to ⅓ of scales dark, edge darker, total impression greyish brown, occasionally few white scales exposed at dorsum; terminal cilia white beyond indistinct cilia-line. Underside of forewing with very large costal fold along basal third, completely covering a pocket with yellow androconial scales of about one quarter wing width (figs. 20, 58). Hindwing with pronounced humeral lobe, along costa with long snow-white hair-scales, inserted on underside, in rest fitting in forewing fold; immediately behind frenulum a small group of closely set, short dark fuscous special scales (figs. 21, 22, 58).

Female. – Forewing length 2.2-2.8 mm (2.52 ± 0.19, 11) wingspan 4.9-6.1 mm. Antenna with 35-38 (36.7 ± 1.3, 10) segments.

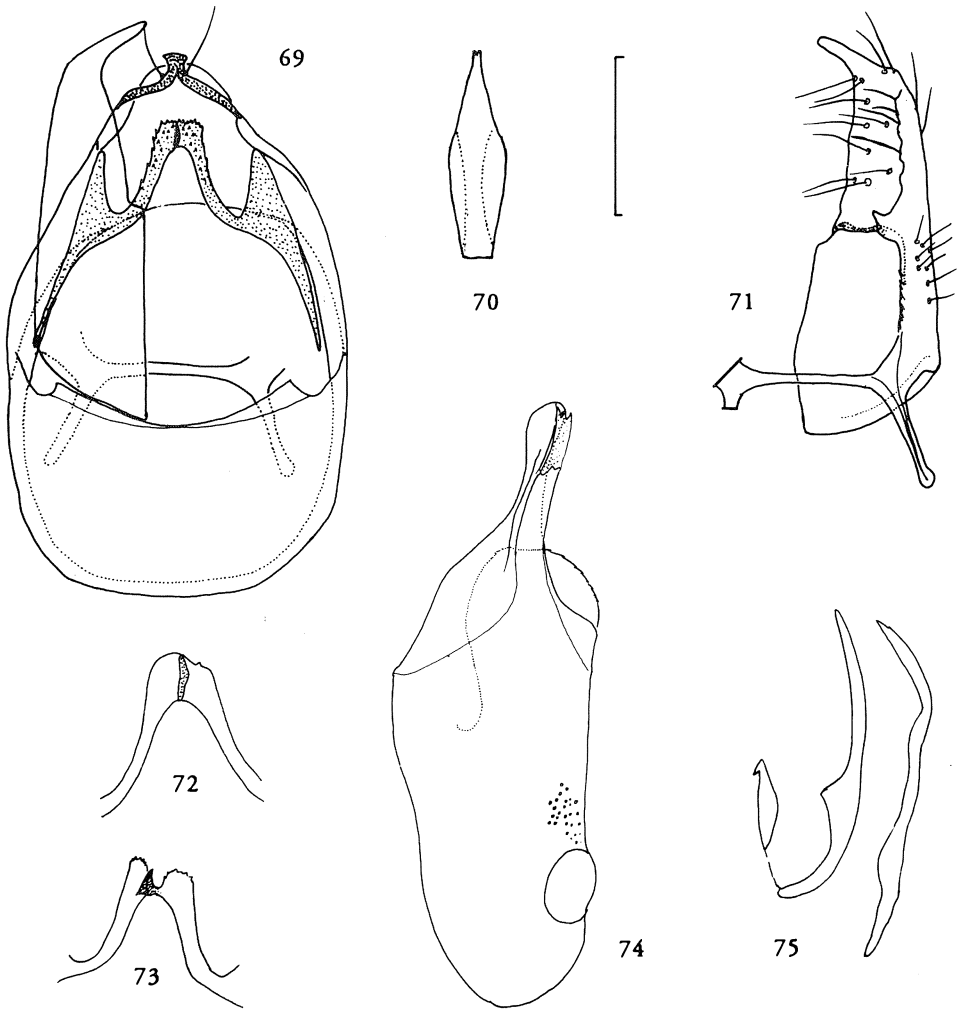
Male genitalia (figs. 69-75) – Capsule length 340-385 μm (363.6 ± 14.5, 11). Vinculum anteriorly truncate. Uncus with medial process distinctly widened terminally and truncate. Gnathos slightly or not asymmetrical, central element narrowly spatulate, with a medial keel ventrally, margins often serrate, additional spines may occur on ventral surface, but specimens without any spines and smooth margin do occur (figs. 69, 72, 73); anterior apodemes conspicuous. Valva length 260-290 μm (273.6 ± 8.3, 11), almost triangular, with inward curved tip; dorsally with a row of several spines along continuation of lateral arm of transtilla, transverse bar of transtilla slightly longer than sublateral processes to twice as long. Aedeagus 335-385 μm (360.0 ± 17.3, 11) long, with ventral carina fringed or bifid, aedeagal tube terminally spatulate, dorsal lobe prominent at right side, with serrate margin; vesica with two large spine-like cornuti, one (155-200 μm, 175.5 ± 13.5, 10) basically joined to a conical cornutus (50-90 μm, 59 ± 11.4, 10), the other subterminally bent, partly hidden amongst group of spine-like cornuti (not measurable); small cornuti numerous. Juxta fig. 70.

Female genitalia (figs. 93, 99). – Terminalia distinctly pointed. T8 with 6-15 setae and some scales; posterior margin truncate; anal papillae with 9-21 setae. Anterior apophyses laterally widened. Ductus spermathecae with 4½ to 5 coils. Signa 340-500 μm long, almost completely similar in length.

Final instar larva (fig. 104) – Yellow, elongate. Headcapsule 375-425 μm long, 1.01-1.11 (1.06 ± 0.03, 6) × as long as wide (in one specimen 1.19×). Headcapsule distinctly longer than in *subnitidella* and *coronillae*. Spinosity: prothorax ventrally with spinose band posteriorly, meso- and metathorax ventrally with a band along anterior margin and few spines laterally. Abdominal segments 1-9 with spines ventrally, not conspicuous; segment 10 with small group of spines anterior of setae.

Diagnosis

Male immediately recognized by large costal fold, hiding the yellow patch (N.B. this fold may be difficult to see in well mounted specimens!), the humeral lobe of the hindwing and the black scales near the frenulum. Male genitalia in particular characterized by gnathos with medial keel, but note variability in gnathos! Female similar to other species in the group, but easily separated by the pointed postabdomen.



Figs. 69-75. *Trifurcula josefklimeschi*, male genitalia. – 69, Capsule, valva outlined, slide 2590; 70, Juxta, slide 2590; 71, Valva, dorsal aspect, slide 2590; 72, 73, Gnathos, showing variation, respectively slides 3068 and 2744 (holotype); 74, Aedeagus, ventral aspect, holotype, slide 2744; 75, Large cornuti, separately drawn, holotype. Scale 0.1 mm.

Biology

Hostplants. – *Dorycnium hirsutum* (L.) Ser. and *D. pentaphyllum* Scop., both perennial herbs or small shrubs, widely distributed in southern Europe, probably also on the other two European *Dorycnium* species (*D. rectum* (L.) Ser. in DC. and *D. graecum* (L.) Ser. in DC.).

Life history. – Egg usually deposited on the underside of a leaflet, occasionally on the stem. When in a leaflet, the larva starts with a short and narrow linear mine (fig. 105), leading either in a straight or slightly contorted course towards the petiole, through which it enters the stem (fig. 105). The larva then usually feeds downward first, in a rather straight line, often doubling back once or twice, before the larva quits the mine through a semicircular slit. The whole course of the mine often staining reddish or brown, frass hardly visible externally, larva visible as a yellow swelling in the stem. The mine is frequently in the more terminal shoots, and can relatively easily be found because of the staining. When full-grown larvae or empty mines are collected, the leaflet with the early mine has often already been fallen.

Larvae have been found in January, February and early April. Adults emerged in mid April (from

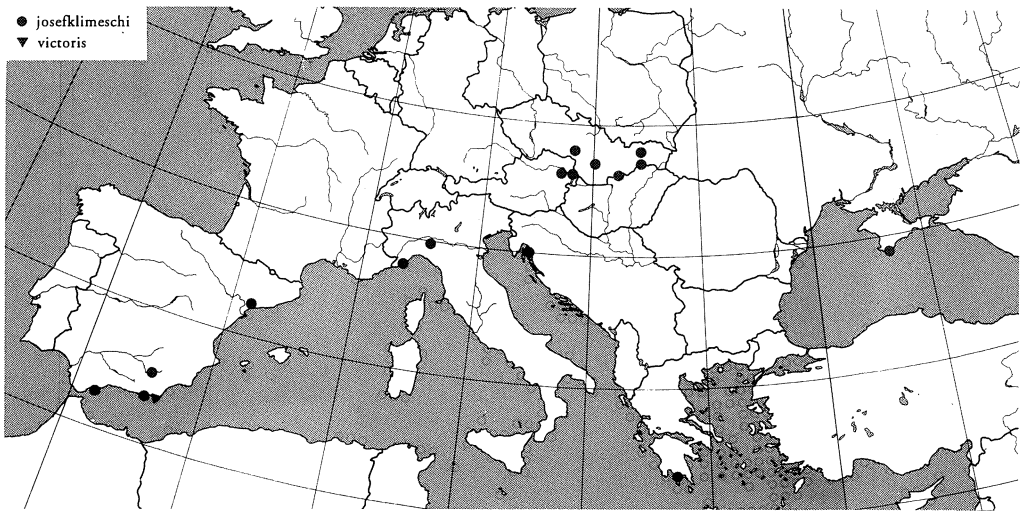


Fig. 76. Distribution of *Trifurcula victoris* and *T. josefklimeschi*, mapped on 50 × 50 km UTM squares.

Greece), the second half of May and in June (indoor rearing), but were caught from late May until the 12th of September, the largest numbers being taken in June and from late August until early September. This pattern might indicate a bivoltine cycle, but this should be confirmed by finding larvae in summer.

Distribution (fig. 76)

Widely distributed in southern Europe, from southern Spain eastward to the Crimea, northwards to eastern Austria and Slovakia. Not yet recorded, but to be expected from Portugal, France, Hungary, Rumania, Bulgaria and Turkey.

Remarks

Material of this species has long been known in collections, but was incorrectly identified as *Trifurcula orientella* Klimesch. In fact, all four specimens from Austria, listed amongst the type-material by Klimesch (1953: 169) appeared to belong to this species, which clearly differs from the specimen which genitalia were illustrated by Klimesch (1953: fig. 15) and is selected lectotype of *orientella* below.

Etymology

A noun in genitive case, named in honour of Dr. Josef Klimesch, who did much pioneer work on the genus *Trifurcula* and on mediterranean Nepticulidae in general.

8. Trifurcula iberica sp. n.
(figs. 29, 59, 77-82)

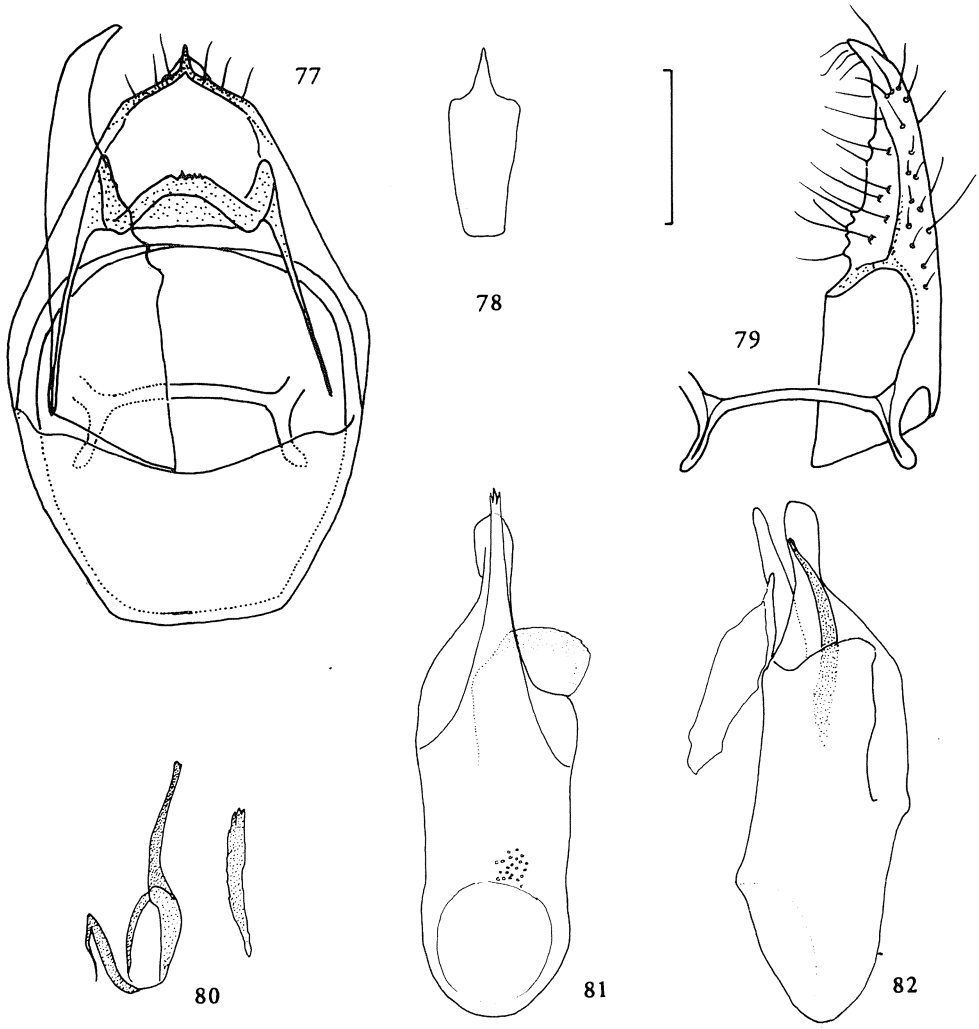
Type material. – Holotype ♂: Spain, Sierra Nevada, road to Veleta (Granada), 1700 m, UTM: 30S VG60, 9.vii.1971, E. Arenberger (LNKD). – Paratype: 1 ♂: Spain, Pyrenees, Prullans, 900 m, UTM: 31T CG99, 2.vii.1980, G. Derra (coll. Derra).

Description

Male. – Forewing length 2.7-3.2 mm, wingspan 6-7.2 mm. Head: frontal tuft ochreous yellow, collar paler. Antenna with 37-40 segments; scape yellowish white, with some brown scales. Forewing and thorax covered with brown tipped scales, total impression pale brown; terminal cilia white beyond more or less distinct cilia-line. Underside of forewing with basal patch of yellow androconial scales extending to ¼. Hindwing with white hair-scales instead of costal bristles; along costa a row of short but conspicuous black special scales, running from ¼ to middle of hindwing (fig. 59).

Female unknown.

Male genitalia (figs. 77-82) – Capsule length 345-355 μm. Vinculum anteriorly truncate, rather narrow. Uncus with medial process pointed, some lateral setae present. Gnathos almost symmetrical or slightly asymmetrical, central element truncate to rounded, posterior margin distinctly serrate; anterior apodemes present. Valva length 275 μm, narrow triangular, gradually narrowed towards tip, dorsal excavation less than half length; transverse bar of transtilla up to three times as long as sublat-



Figs. 77-82. *Trifurcula iberica*, male genitalia, slide 2741 (77-80) and 1928 (holotype: figs. 80, 82). – 77, Capsule, valva outlined; 78, Juxta; 79, Valva, dorsal aspect; 80, Large cornuti, separately drawn; 81, Aedeagus, ventral aspect; 82, Aedeagus, lateral aspect, position of spinelike cornutus shown. Scale 0.1 mm.

Diagnosis

The male of *iberica* is easily distinguished from other species in the group by the long row of black scales on the hindwing costa. The genitalia are characterized by the almost symmetrical gnathos with serrate margin, but resemble those of *silviae*, see there.

Biology

Hostplant and immature stages unknown. Adults taken in mountains, at medial (900 m) and high altitude (1700 m), both in July.

Distribution (fig. 29)

Only known from two specimens from the Spanish Pyrenees and Sierra Nevada.

Etymology

A latin adjective, from *Ibericus* (= *Hibericus*), meaning Spanish, referring to the single localities in the Spanish mountains.

9. **Trifurcula silviae** sp. n.
(figs. 7, 29, 60, 83-88, 94, 100)

Type material. – Holotype ♂: France, 1 km NW Ceillac, ± 10 km S Chateau-Queyras (Htes Alpes), 1800 m, UTM: 32T LQ2449, 24.vii.1987, alpine meadow on S. slope, netted at dusk, EvN no. 87139, van Nieukerken & Richter (RMNH). – Paratypes: 6 ♂, 1 ♀. France: 1 ♂, data as holotype (RMNH); 1 ♂, Chaner. [not traced, ?near Digne], 22.viii.1903, Chrétien (MNHN); 2 ♂, Digne (Alp. Ht. Prov.), UTM: 32T KP78, viii.1903, (MNHN); 1 ♂, Puy Vacher [near La Grave] (Htes Alpes), [2000 m], UTM: 32T KQ88, 29.vi.1898, (MNHN); 1 ♂, Viens (Vaucluse), UTM: 31T GJ0664, 21.viii.1974, R. Buvat (coll. Buvat); 1 ♀, same data, but 8.viii.1975 (RMNH).

Description

Male (fig. 7). – Forewing length 2.6-3.1 mm (2.80 ± 0.18, 6), wingspan 5.8-7.0 mm. Head: frontal tuft pale yellow, mixed with white, collar yellowish white. Antenna with 35-39 segments (36.5 ± 1.5, 6) ; scape white. Forewing and thorax relatively pale ochreous yellow, scales with ochreous brown tips mixed with completely white scales; terminal cilia white, cilia-line obsolete or absent. Underside of forewing without patch of androconial scales, narrow costal fold relatively well developed, edged with row of brown scales (fig. 60). Hindwing almost white, costa of humeral lobe with row of short dark brown scales, running to ⅓ (fig. 60).

Female. – Forewing length 2.6 mm, wingspan 5.8 mm. Antenna with 32 segments.

Male genitalia (figs. 83-88) – Capsule length 300-330 μm. Vinculum anteriorly truncate. Uncus with medial process truncate, not widened, with several lateral setae. Gnathos slightly or not asymmetrical, central element narrow, posterior margin distinctly serrate; anterior apodemes hardly visible. Valva length 215-240 μm, narrow triangular, tip short pointed, slightly curved, transverse bar of transtilla about 1.5 times as long as sublateral processes. Aedeagus 310-340 μm long, with ventral carina fringed, aedeagal tube apically pointed, dorsal lobe at right side prominent, margin serrate; vesica with long pointed cornutus (140-210 μm), basally joined to conical cornutus (75 μm), a long cornutus with serrate tip hidden amongst group of long needle-like cornuti, many small cornuti present. Juxta fig. 84.

Female genitalia (figs. 94, 100). – Terminal segments broadly rounded. T8 with about 6 setae and few scales; anal papillae with 23-25 setae. Ductus spermathecae with 4 coils. Signa 335-365 μm long.

Diagnosis

Male differs from all other species in the *subnitidella* group by the absence of the yellow patch, it is also paler than most species, except *luteola*. *T. silviae* male differs from other pale *Trifurcula* species of similar size by the distinct rows of brown scales along costal fold of forewing and along hindwing costa. Male genitalia differ from similar *iberica* by relatively longer sublateral processes and slightly broader valva. Female differs from other species described here by paler colour and blunt ovipositor.

Biology

Hostplant and immature stages unknown. The holotype and one paratype were collected in an alpine meadow on a steep southern slope, where the Fabaceae *Lotus corniculatus* L., *Anthyllis vulneraria* L. and *Onobrychis montana* DC. are the most likely candidates to be its host. The species apparently occurs over a wide range of habitats, from almost lowland mediterranean localities (Viens, Digne), to high alpine country (Ceillac: 1800 m, Puy Vacher: ca 2000 m.). Adults have been caught from June to August.

Distribution (fig. 29)

Only known from a relatively small area in southeastern France, in the Alps and pre-alps.

Remarks

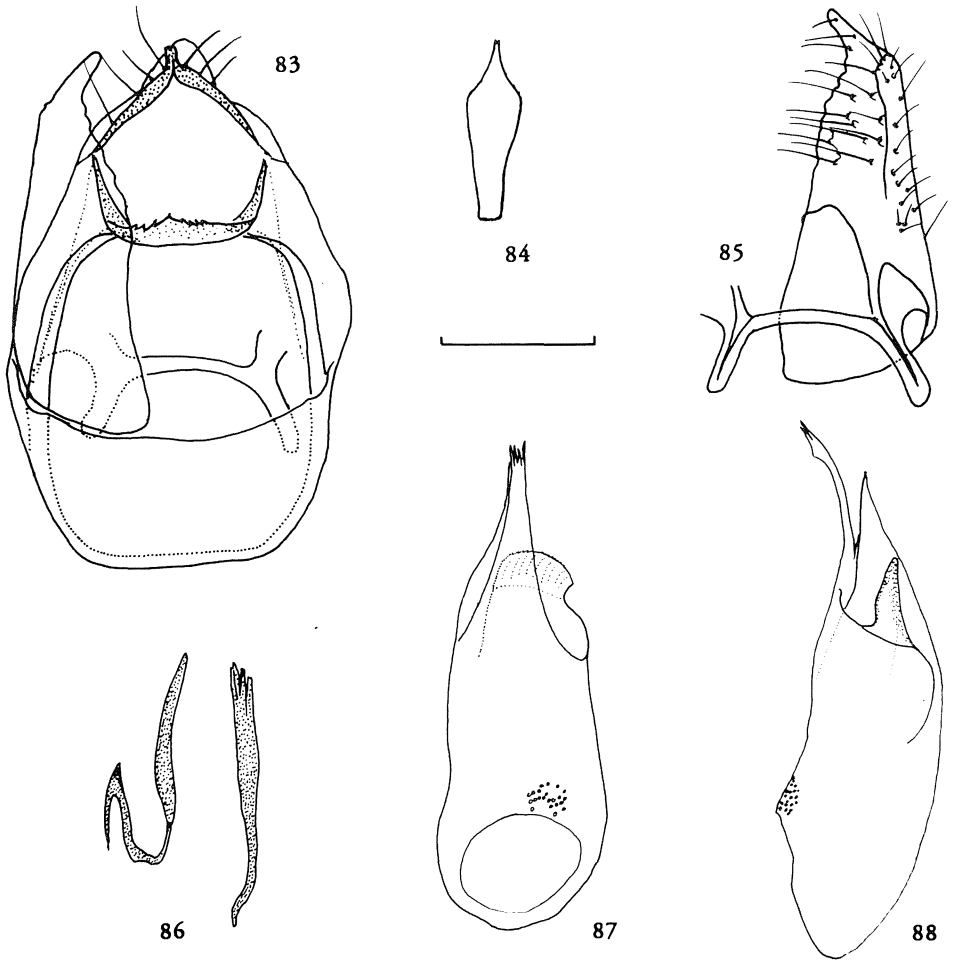
The specimens in the Chrétien collection were found amongst material of *T. immundella*, together with a number of other misidentified species. The single female is considered to belong to *silviae* on the basis of its occurrence with one male and no other related species, the external characters and the genitalia, which clearly belong to a species in the *subnitidella* group.

Etymology

A noun in genitive case, named in honour of my wife Silvia Richter, who not only collected both holotype and one paratype, during an alpine mountain hike, but contributed much to the collecting during many joint field trips.

Phylogeny of the Trifurcula subnitidella group

The phylogeny of the genus *Trifurcula* and its three subgenera has been dealt with by Scoble (1980) (with the present subgenera as genera) and van Nieukerken (1986b). In these studies it has been shown that the subgenus *Glaucolepis* Braun (=*Fedalmia* Beirne) is the sistergroup of [*Levarchama* Beirne + *Trifurcula* s.str.] and that the latter two subgenera are sistergroups to each other. Both the monophyly of the genus and subgeneric clades has been amply demonstrated by apomorphies, to which little is to be added. Only one more apomorphy for *Levarchama* has been mentioned by van Nieukerken & Johansson (1990): the costal hair-pencil on the hindwing underside. The apomorphy for *Trifurcula* s. str: uncus divided dorsoventrally needs to be re-examined: in my opinion



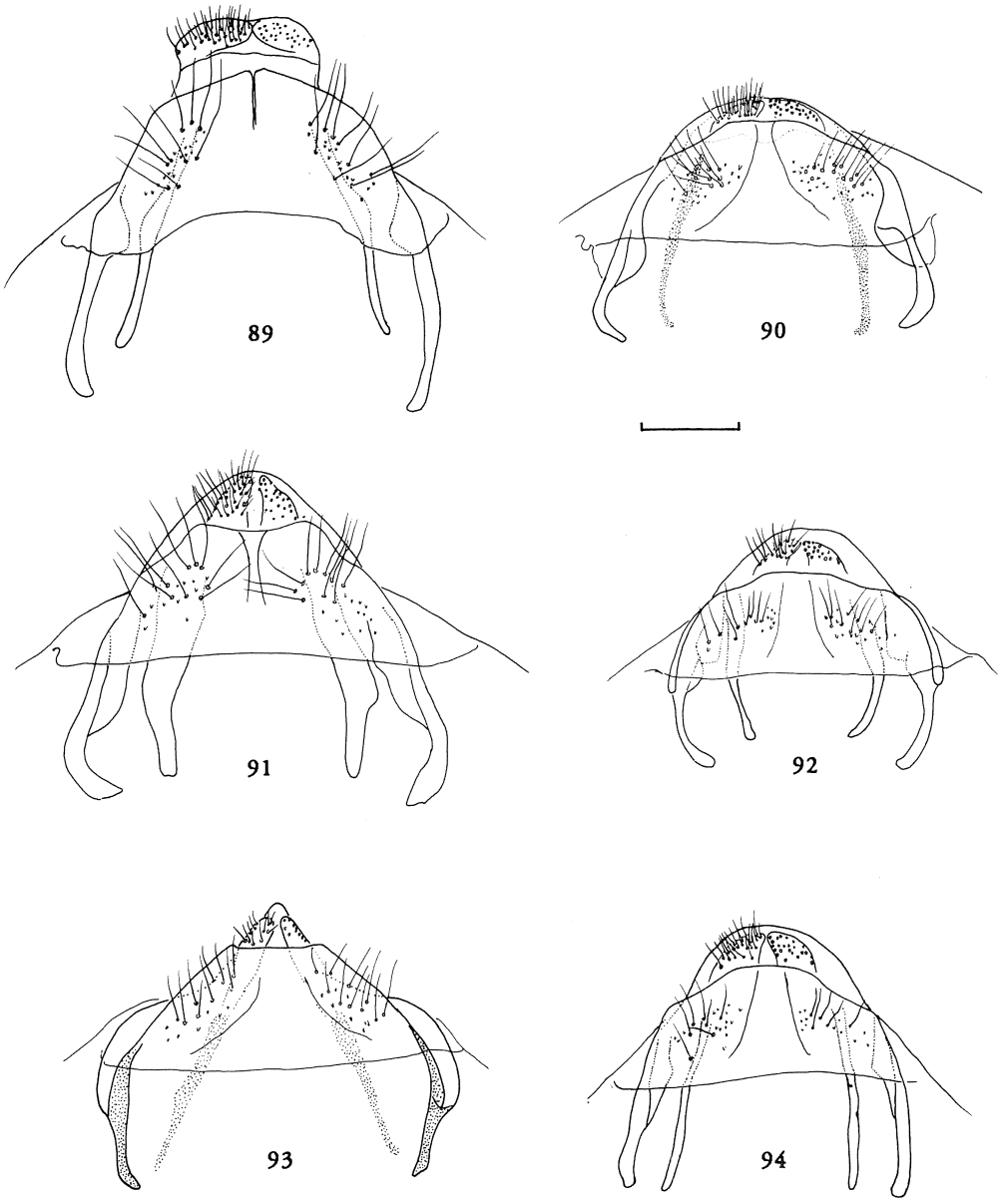
Figs. 83-88. *Trifurcula silviae*, male genitalia. – 83, Capsule, valva outlined, holotype, slide 2742; 84, Juxta, slide 2604; 85, Valva, dorsal aspect, holotype; 86, Large cornuti, separately drawn, slide 2606; 87, Aedeagus, ventral aspect, slide 2606; 88, Aedeagus, lateral aspect, holotype. Scale 0.1 mm.

the ventral less sclerotized part, interpreted as part of the uncus by Scoble (1980), might well be a somewhat better sclerotized anal tube. This needs to be confirmed by detailed examination of whole mounts of complete genitalia, and might still be an apomorphy for the subgenus. In any case, a new interpretation of this character does in no way jeopardize the monophyly of *Trifurcula* s. str.

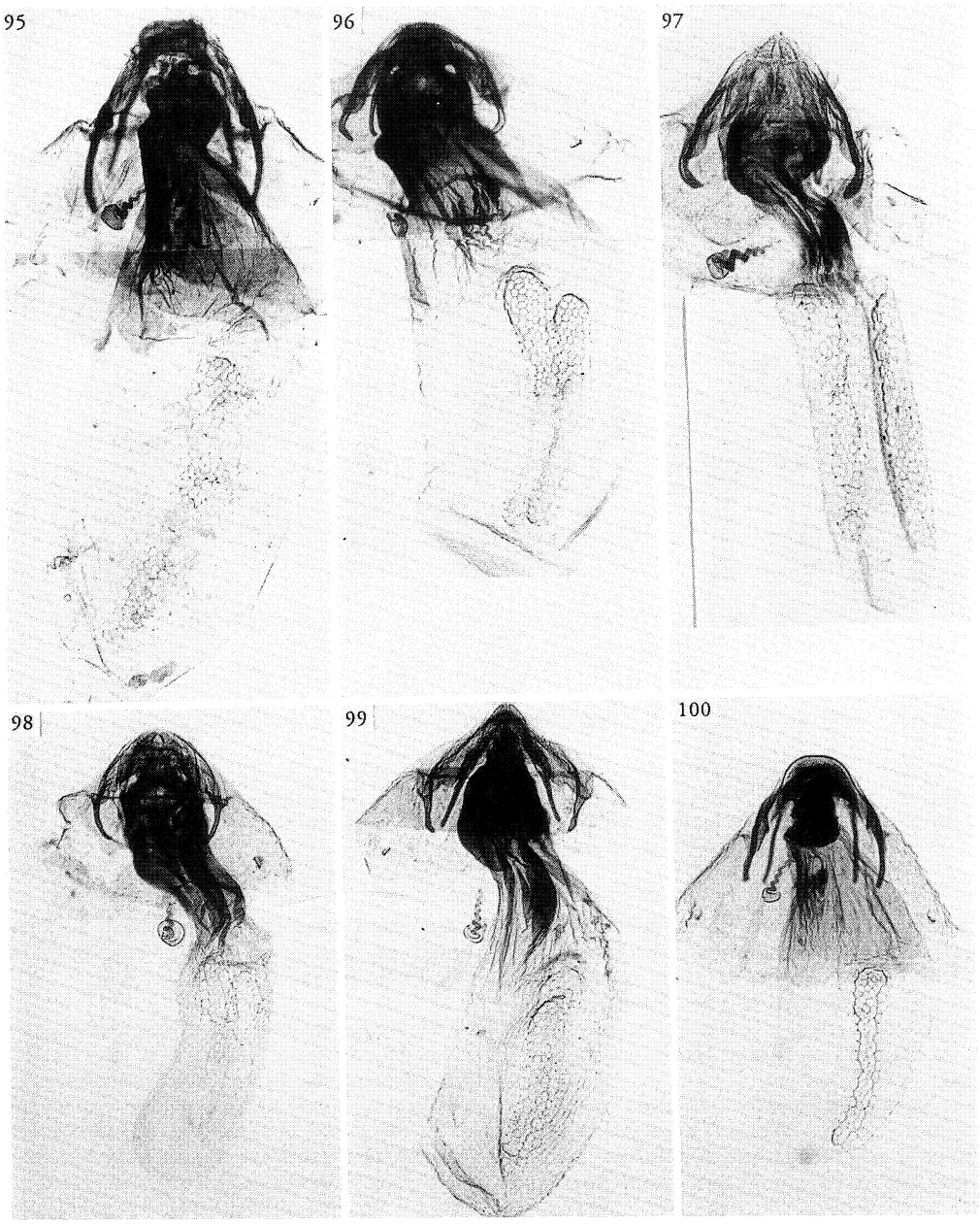
The phylogeny within this subgenus has not been discussed before, except the position of the two South African species, discussed by Scoble (1980), who could not solve the question whether they together form the sistergroup of [*Levarchama* + *Trifurcula*] or the sistergroup of Palaearctic *Trifurcula* s. str. I will come back to that question below, and first concentrate on the Palaearctic species.

For an evaluation of the polarity of characters, *Levarchama* has been used as outgroup. In this study *Trifurcula* s. str. has been divided in two species groups, which are believed to be monophyletic sistergroups. The phylogeny of the *subnitidella* group is presented in the cladogram in fig. 108. Monophyly of the *subnitidella* group is actually based on one character only:

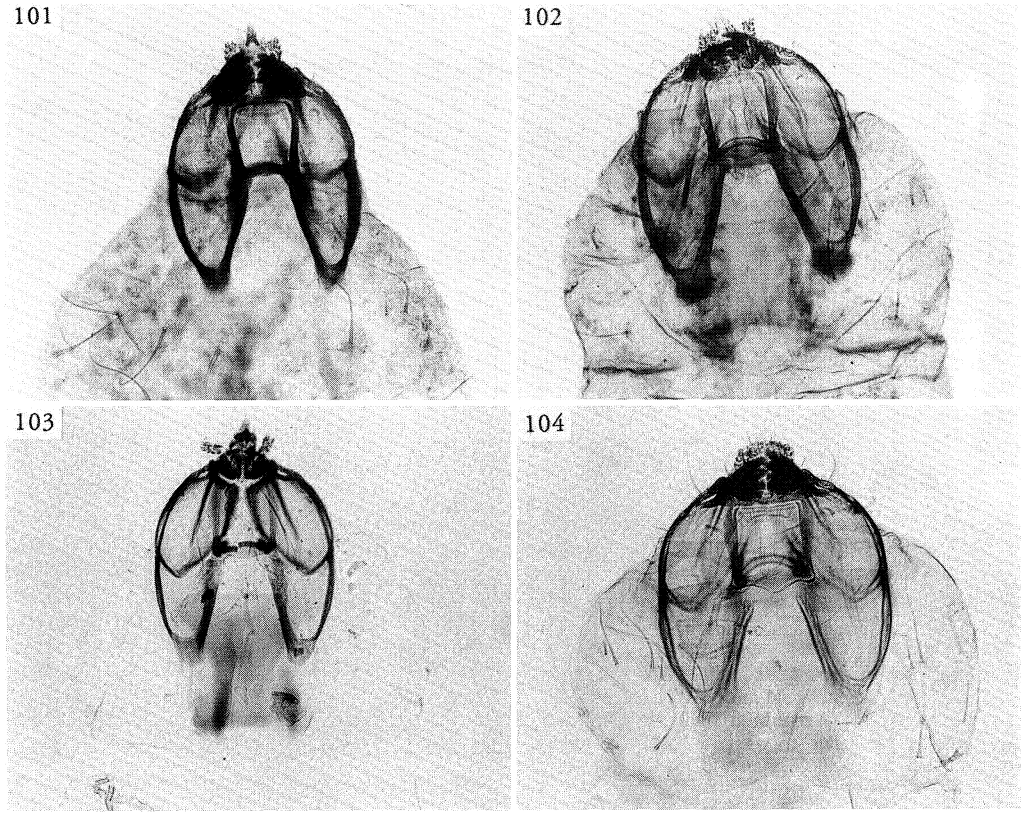
1. Male forewing with patch of yellowish androconial scales on underside, near wingbase. Such androconial scales are absent in *Levarchama* and in the *pallidella* group, and not completely similar scales are only found in a subgroup of *Glaucolepis*, so that



Figs. 89-94. *Trifurcula* spp., female postabdomen, dorsal aspect. – 89, *T. puplesisi*, slide 2763; 90, *T. coronillae*, slide 2750; 91, *T. victoris*, slide 2751; 92, *T. subnitidella*, slide 2746; 93, *T. josefklimeschi*, slide 2748; 95, *T. silviae*, slide 1818. Scale 0.1 mm.



Figs. 95-100. *Trifurcula* spp., female genitalia. – 95, *T. puplesisi*, slide 2763; 96, *T. coronillae*, slide 2750; 97, *T. victoris*, slide 2752; 98, *T. subnitidella*, slide 2746; 99, *T. josefklimeschi*, slide 2748; 100, *T. silviae*, slide 1818.



Figs. 101-104. *Trifurcula* spp., final instar larva, headcapsule. – 101, *T. coronillae*, Spain, Istan; 102, *T. victoris*, Spain, San José; 103, *T. subnitidella*, Netherlands, Kunrade; 104, *T. josefklimeschi*, Spain, Sierra Blanca.

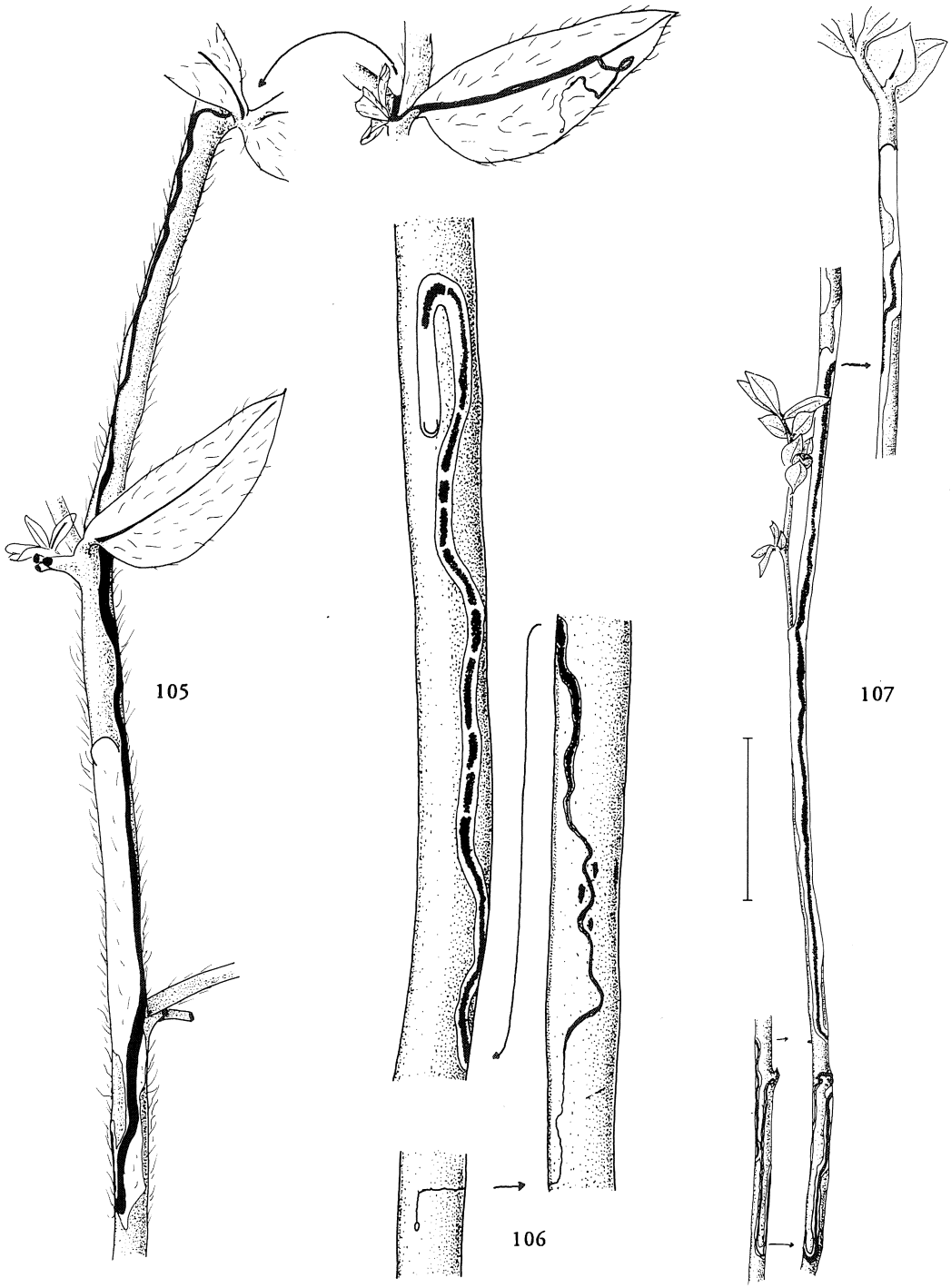
the presence of these scales is regarded as an evolutionary novelty. They are secondarily lost in *silviae*, which can be regarded to belong to the *subnitidella* group on the basis of other characters.

The *pallidella* group is believed to be monophyletic on the basis of at least the following apomorphy:

2. Hostplant belonging to the Genisteae ('brooms'). The hostplants of *Levarchama* and the *subnitidella* group belong to other tribes of Fabaceae: Loteae and Coronilleae, thus on the basis of the outgroup rule, a hostplant belonging to Loteae or Coronilleae is the plesiomorphous condition, and hence Genisteae apomorphous. No other Nepticulidae are known to feed on brooms. Although only few species have actually been reared, evidence is accumulating that indeed all species are associated with brooms.

3. A doubtful apomorphy is the form of the larger cornuti: two are curved and one is spine-like in virtually all species.

The current position of the first species of the *subnitidella* group, *T. austriaca*, is tenuous. It is included here solely on the basis of the yellow patch and the general external resemblance to other species in the group. The genitalia, in particular the aedeagus, resemble more the *pallidella* group, although they show some peculiarities, not noticed in other species, such as the curved carinal lobes. If the aedeagal characters (shape of cornuti, dorsal lobe) belong to the groundplan of the subgenus, and *austriaca* has no broom species as host, it still belongs to the *subnitidella* group, and possibly is the sister-species of all other species together. On the other hand, if it is found to have a species of broom as



Figs. 105-107. Larval stem-mines of *Trifurcula* species. – 105, *T. josefklimeschi*, mine in *Dorycnium hirsutum*, Spain, Sierra de Marbella; 106, *T. coronillae*, mines in *Coronilla juncea*, type locality; 107, *T. subnitidella*, mines in *Lotus corniculatus*, Netherlands, Kunrade. Scale 1 cm.

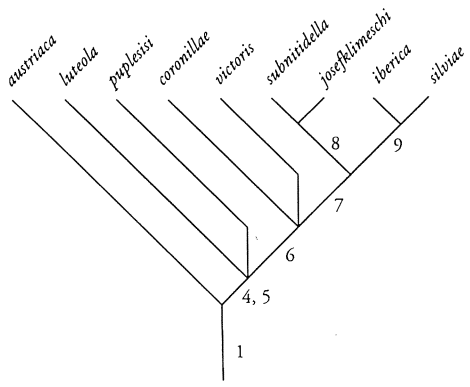


Fig. 108. Cladogram of *Trifurcula subnitidella* group, numbers refer to apomorphies, explained in text.

host, it is possibly misplaced here meaning that the androconial patch has apparently evolved twice independently, or that it should be regarded as an underlying apomorphy. Awaiting further information of this species, *austriaca* is tentatively treated here in the *subnitidella* group.

The remaining eight species share the following characters as apomorphies:
4. Aedeagus terminally narrowed, dorsal lobe well developed, at right side or in middle; often with serrate margin.
5. Pattern of the three large cornuti: one spine-like, basally joined with a conical, and a long irregular (often spine-like) cornutus hidden amongst the group of needle-like cornuti.

The first branching in this clade has not been resolved, and is provisionally presented as a trichotomy. The species *luteola* and *puplesisi* resemble each other closely, but the similarities seem to be mere plesiomorphies, so that their phylogenetic relationship cannot be demonstrated. The remaining six species form a better defined monophyletic entity on the basis of the apomorphy:
6. Gnathos highly atypical for Nepticulidae, with keels and/or serrations, often highly asymmetrical. The gnathos of the previous species resembles that of the *pallidella* group, it is symmetrical and never with keels, and thus forms the plesiomorphic condition within the subgenus.

Also in the next clade the first branching is presented as a trichotomy, since the monophyly of [*coronillae* + *victoris*] could not be demonstrated. The monophyly of the final four species is based on the following unique character:
7. Hindwing costa in male with characteristic black or dark brown androconial scales

T. subnitidella and *josefklimeschi* are tentatively regarded as sister-species on the basis of their similarity and one possible apomorphy:
8. Black scales along hindwing costa confined to small group close to frenulum.

Finally, *T. iberica* and *silviae* most likely are sister-species, also on the basis of a general similarity in habitat, externals and genitalia of which the following character might be regarded as apomorphy:
9. Gnathos without keels, but with serrated margin.

The phylogeny of the *subnitidella* group is still based on relatively few characters, more detail of females, immature stages and hostplants would be most welcome in order to refine the cladogram.

One final point to discuss here, is the phylogenetic position of the two South African species, described by Scoble (1980).
Only males are known from these species, so that we have no biological data to support our theories. In my opinion both species definitely belong to *Trifurcula* s. str. on the basis of the group of needle-like cornuti, an apomorphy for the subgenus, and the absence of a split uncus (in ventral view), a character for *Levarchama*. However, the hair-pencil of *T. barbertonensis* Scoble (fig. 12 in Scoble), closely resembles that of *Levarchama*, which might suggest another solution. Since no biological data are available, and since it is unknown whether these species have a patch of androconial scales on the forewing underside, it is yet impossible to assign them to one of the Palaearctic species groups. The aedeagus as figured by Scoble (1980) seems to be different from both species groups, so that it is still possible that the South African species form the sistergroup of the Palaearctic *Trifurcula* s. str.

APPENDIX

Trifurcula orientella Klimesch

Trifurcula orientella Klimesch, 1953: 168, 169, fig. 15. Lectotype ♂ (here designated): Yugoslavia, Dalmatia mer., Umg. v. Gravosa, 15-31.v.1939, J. Klimesch, 'Holotypus', genitalia slide Kl. 511 (coll. Klimesch) [examined].

Trifurcula orientella was described on the basis of six male specimens from Gravosa, Yugoslavia and four male specimens from Austria. When I found the austrian specimens in the Vienna museum, they appeared to have genitalia differing from the figure, presented by Klimesch, and actually appear to belong to the species here described as *josefklimeschi*. Since Klimesch's figure clearly has been the basis for the identity of *orientella*, it seems most appropriate to select the specimen used for this figure as lectotype. This is also the specimen labelled by Klimesch 'Holotypus'. Unfortunately, two other paralectotypes from the type locality, examined by me, also appear to belong to another and larger

species, either *T. immundella* Zeller or a closely related species, which has been reared by me from *Calycotome*. The remaining three paralectotypes have not been examined by me.

T. orientella is a relatively small species, clearly belonging to the *pallidella* group, which is known from the Dalmatian coast, the isle of Krk (leg. Baldizzone) and from Conna on the Italian Riviera. From the latter locality I have reared this species from stem-mines in the broom *Genista germanica* L.

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Unfortunately the following errors have been overlooked during proof-reading of the above cited paper:

p. 207. – Figs. 7-10: figs 9 and 10 have been accidentally interchanged, the left figure with no. 9 actually is fig. 10 (*T. coronillae*), the right one is fig. 9 (*T. subnitidella*). Arrows in figs 8-10 have been omitted.

p. 222. – Figs. 57-60. Abbreviations: bs=black scales; cf=costal fold; fw=forewing; hw=hindwing; yp=yellow patch.

p. 228. – The sentences after the last paragraph of p. 228 (male genitalia of *iberica*) were accidentally omitted during page formatting:

[sublat-]eral processes. Aedeagus 335-340 μm long, with ventral carina fringed; aedeagal tube posteriorly spatulate, dorsal lobe at right side conspicuous, with serrate margin; vesica with one long spine-like cornutus (125-145 μm), with blunt tip, joined basally to a conical cornutus (50 μm); further a large cornutus with serrate tip; very few long spine-like cornuti and numerous small ones. Juxta fig. 78.

p. 230. – Line 1-2, right column: read hind-wing in stead of hindwing.

In some holotype designations, the genitalia slide number has not been mentioned, they are:

p. 219, 5. *T. victoris*: Genitalia slide EvN 2743.
p. 225, 7. *T. josefklimeschi*: Genitalia slide EvN 2744.
p. 228, 8. *T. iberica*: Genitalia slide EvN 1928.
p. 230, 9. *T. silviae*: Genitalia slide EvN 2742.