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BUCCULATRIX TANACETI SP. NOV., AN OVERLOOKED CRYPTIC SPECIES SEPARATED FROM THE *BUCCULATRIX HUMILIELLA* HERRICH-SCHÄFFER, [1855] SPECIES-COMPLEX (LEPIDOPTERA, BUCCULATRICIDAE)

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TOKÁR, Z. 2026. *Bucculatrix tanaceti* **sp. nov.**, an overlooked cryptic species separated from the *Bucculatrix humiliella* Herrich-Schäffer, [1855] species-complex (Lepidoptera, Bucculatricidae). *Entomofauna carpathica*, 38(1): 59-76.

Abstract: Analysis of external appearance, genital morphology and DNA barcoding results indicate that the name *Bucculatrix humiliella* Herrich-Schäffer, [1855] sensu auctorum represents a species-complex consisting of two distinct taxa. *Bucculatrix tanaceti* **sp. nov.** is here described as a separate species associated with *Tanacetum vulgare* L., while the host-plant of the true *B. humiliella* is *Achillea millefolium* L. The new species is compared with several species names considered synonymous with *B. humiliella*, including *Bucculatrix capreella australis* Nel, 1999, **syn. nov.** Colour photographs and/or illustrations of the adults, male and female genitalia, the immature stages, and the habitat are provided.

Key words: Lepidoptera, Bucculatricidae, *Bucculatrix tanaceti*, new species, taxonomy, bionomics, distribution

INTRODUCTION

Bucculatrix Zeller, 1839 is a large genus within the family Bucculatricidae Fracker, 1915 comprising approximately 300 described species worldwide (van NIEUKERKEN et al. 2011). New species in this genus have been occasionally described in recent years (e.g. MEY 2019; LIAO et al. 2019; WANG et al. 2020; LIU and LIU 2022; YAGI et al. 2024; OH et al. 2024; NEL and VARENNE 2026), but many additional species are known and awaiting formal description. The genus is well-known for its specialized larval biology, characterized by an initial leaf-mining phase followed by external feeding and the construction of distinctive ribbed pupal cocoons (BRAUN 1963).

Several authors have attempted to divide this large genus into smaller groups. BRAUN (1963) divided the Nearctic fauna into eight sections based on genitalia and correlated with host-plants. BARYSHNIKOVA (2008) split Holarctic species into 16 species-groups using phylogenetic analyses based on morphological and biological characteristics. KOBAYASHI et al. (2010) presented 10 species-groups for 23

Bucculatrix species distributed in Japan based on their morphological features. Subsequently, BARYSHNIKOVA (2013), in a survey on the bucculatricid moths of Russia and adjacent territories, developed a system of 13 species-groups. However, it should be noted that the subdivision of *Bucculatrix* into subgroups will require revision based on more recent knowledge gained from DNA analyses as well as the morphology of newly described species (MEY 2019; Yagi et al. 2024).

In the existing system of BARYSHNIKOVA (2013), the *B. gnaphaliella* (Treitschke, 1833) species-group is the largest, with more than 100 predominantly Holarctic species. This group also includes species from Section II of BRAUN (1963) and Group 2 of KOBAYASHI et al. (2010).

Species from the *B. gnaphaliella* group are biologically associated with host-plants in the family Asteraceae and are morphologically defined by specific characters of the genitalia of both sexes. In the male genitalia, these include: a tegumen with widely spaced socii lobes; a relatively short and wide vinculum with medial sclerotization; the valva often with short conical setae at the apex; and a relatively long to very long, proximally widened phallus, usually without cornuti or spines. In the female genitalia, diagnostic characters include: modification of the papillae anales into rasping rods; tufts or patches of specialized scales on segment 8; and reduced or absent anterior apophyses (BRAUN 1963; BARYSHNIKOVA 2013).

Adults of the *B. gnaphaliella* group are usually very similar in coloration and forewing pattern, and variation within a single species may exceed the differences between distinct species. Moreover, differences in the genitalia structures of closely related species are often subtle. For these reasons, a combination of external appearance, male and female genitalia, DNA analysis, and, where available, data on the biology of preimaginal stages, allows for the identification of cryptic species with great certainty. This is also the case for *Bucculatrix humiliella* Herrich-Schäffer, [1855] sensu auctorum, belonging to the *B. gnaphaliella* group. This taxon in fact represents a complex of two species. By combining the factors mentioned above, it was possible to isolate and describe a new species, which is the subject of this paper.

MATERIAL AND METHODS

Specimens of the new species were collected as adults using entomological nets or attracted to light traps. Two specimens were reared from larvae found on the host-plant *Tanacetum vulgare* L. Genitalia were dissected following the standard procedure for small Lepidoptera, embedded in Euparal on glass slides, or stored in small plastic vials filled with glycerol.

Photographs of adults were taken using a Keyence digital microscope VHX-X1 (A. Tkáč), a Canon EOS 200D camera (G. Elsner), and a Canon EOS 5D Mark III

camera with a Canon lens MP-E 65 at 2:1 magnification and a ring flash. For figures taken with the latter camera, approximately 20 photos were stacked using Helicon Focus 4.80 and edited in Adobe Photoshop 6.0 (P. Buchner).

Photographs of the genitalia were taken using a Samsung Digimax V4 camera mounted on a Nikon M Plan 20x microscope (G. Elsner), or a Zeiss Axiolab 5 microscope connected to an Olympus OM-D Mark III camera and stacked photos were edited using Helicon Focus 8.0 and Adobe Photoshop 6.0 (P. Huemer). Photographs of the immature stages and the habitat were taken by using Canon PowerShot G11 and Nikon D 3300 digital cameras. Line drawings of the genitalia were prepared using India ink on transparent tracing paper.

Specimens are deposited in the following scientific collections: Zdenko Tokár, Ignác Richter, František Kosorín, Branislav Endel, Roland Štefanovič, Gabriel Pastorális, Jari Junnilainen, Jari-Pekka Kaitila, NHMO, NMPC, TLMF, and ZMKU.

Molecular analysis. Single legs from several specimens of the new species were sent to the Canadian Centre for DNA Barcoding (CCDB; University of Guelph) to obtain COI barcodes. This sampling was supplemented with records of the same species from the TLMF and other related species available in the BOLD database (see Acknowledgements). The barcode datasets of the new species have been deposited as DS-BUCCNEW "New *Bucculatrix* species" (released publicly: dx.doi.org/10.5883/DS-BUCCNEW) and as DS-BUCCAUT "New *Bucculatrix* from Central Europe" in the Barcode of Life Data System (BOLD) (Ratnasingham and Hebert 2007). Genetic distance estimations were performed using BOLD analytics, and a Neighbor-joining tree was constructed using MEGA5 (TAMURA et al. 2011).

Abbreviations

BOLD	Barcode of Life Data System
Gp., Gs.	Genitalia preparation, genitalia slide
INRAE	Institut National de la Recherche Agronomique, Orléans, France
ISEZ PAN	Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland
MZH	Museum Zoologicum Helsingiense, Helsinki, Finland
NHMO	Naturhistorisk museum Oslo, Norway
NHMUK	Natural History Museum, London, United Kingdom
NHMW	Naturhistorisches Museum Wien, Vienna, Austria
NMPC	National Museum, Prague, Czechia
NR	Nature reserve
PA	Protected area
SAC	Special Area of Conservation
TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria
ZMB	Zoologisches Museum Berlin, Germany
ZMKU	Zoological Museum, Taras Shevchenko National University of Kyiv, Ukraine
ZT	Zdenko Tokár

Taxonomy

Bucculatrix tanaceti sp. nov.

Figs 1-3, 7, 12

Holotype: Slovakia, Michalovce, Biela hora, 120 m (48°46'22"N, 21°55'33"E), ex larva 6.x.2022, ♀, larva 10.ix.2022, DNA sample TLMF Lep 38648, leg. Z. Tokár, in coll. Z. Tokár (to be deposited in NMPC).

Paratypes: Slovakia: • The same locality as holotype, 19.viii.1995, 1♀ (Gp. ZT 10154), 30.iii.2002, 2 ex. (Gp. ♂ ZT 7831), 12.vi.2002, 3 ex., 24.vii.2002, 4 ex. (Gp. ZT ♂ 7032, ♀ 7834, ♀ 10155), 24.vii.2003, 1 ex., 8.viii.2020, 4 ex., ex larva 27.ix.2020 (larva 10.ix.2020), 7.ix.2021; • Pozdišovce, 127 m (48°43'56"N, 21°50'44"E), 13.iv.2001, 1 ex., 25.viii.2002, 1 ex., 16.vii.2003, 1♂ (Gp. ZT 10122), 15.vii.2007, 1 ex., 1.viii.2008, 1 ex.; • NR Viniansky hradný vrch, 150 m (48°49'00"N, 21°56'38"E), 7.vi.2001, 1 ex.; • NR Chotínske piesky, 115 m (47°48'44"N, 18°12'50"E), 13.vi.2007, 1♂, DNA sample MM19450; • PA Šurianske slaniská, 116 m (48°05'27"N, 18°07'20"E), 30.vii.2006, 1♂, DNA sample MM19481, • Hájske 1 km S, SAC Juhásove slance, 120 m (48°14'20"N, 17°52'23"E), 17.viii.2009, 1 ex., 15.viii.2020, 1♂ (Gp. ZT 15306), leg. & coll. Z. Tokár; • Malá Čausa, 340 m (48°47'41"N, 18°42'05"E), 7.xii.2011, 1♀ (Gp. ZT 12170), leg. & coll. Ig. Richter; • Rybník, vinice, 220 m (48°18'00"N, 18°34'19"E), 30.viii.2008, 1♂ (Gp. ZT 13334), leg. & coll. F. Kosorín; • Galanta, 116 m (48°11'11"N, 17°43'20"E), 12.vi.2011, 1♂ (Gp. 105 R. Štefanovič), 6.viii.2011, 1♂ (Gp. 71 R. Štefanovič), leg. & coll. R. Štefanovič; • Komárno, Nová Osada, 107 m (47°47'12"N, 18°06'33"E), 15.vi.2017, 1 ex., leg. & coll. G. Pastorális; • Rimavská Sobota 6 km E, NR Ťahan - Hnojník, 260 m (48°23'08"N, 20°06'00"E), 2.vi.2014, 1♂ (Gp. ZT 12313), • Hornádska kotlina, NR Sivá Brada, 480 m (49°00'22"N, 20°43'05"E), 11.viii.2024, 1♂ (Gp. ZT 14749), leg. & coll. B. Endel.

Austria: • Burgenland, NP Neusiedlersee, Biol. Station, 118 m (47°46'20"N, 16°45'59"E), 15.vi.2017, 1 ex., DNA sample TLMF Lep 26470, leg. P. Huemer, coll. TLMF; • Niederösterreich, Wolkersdorf, Anzengruberhoehe, 250 m (48°24'00"N, 16°33'43"E), 31.vii.2017, 1 ex., DNA sample BC LSNOE Lep 01137, leg. W. Stark, coll. Landessammlungen Niederösterreich, St. Pölten; • Carinthia, Atschalas, 480 m (46°39'04"N, 14°20'06"E), 19.x.2018, 1 ex., DNA sample KLM Lep 14324, 20.x.2018, DNA sample KLM Lep 14325, 9.iv.2020, 1 ex., DNA sample KLM Lep 15515, 21.xi.2020, 1 ex., DNA sample KLM Lep 15517, leg. B. Brudermann; • Carinthia, Virunum, Arena, Standort 2, 498 m (46°41'54"N, 14°22'20"E), 30.vii.2024, 1 ex., DNA sample KLM Lep 16312, leg. Ch. Wieser, coll. Landesmuseum Kärnten.

Bulgaria: • Struma River valley, Sandanski meadow, 360 m (41°37'34"N, 23°15'31"E), 28.vii.2013, 1♀ (Gp. ZT 13807), leg. & coll. J. Junnilainen.

Czechia: • Močovice, 250 m (49°54'17"N, 15°20'47"E), 25.vi.2025, 2♀ (Gp. ZT 15305, 15311), 25.vii.2025, 1 ex., 28.vi.2026, 1♀, leg. & coll. Z. Tokár; • Stroupeč near Žatec, Přívlaky, 270 m (50°21'42"N, 13°28'44"E), 20.vi.2023, 1♂ (Gp. 23/344 J. Šumpich), leg. J. Šumpich, coll. NMPC.

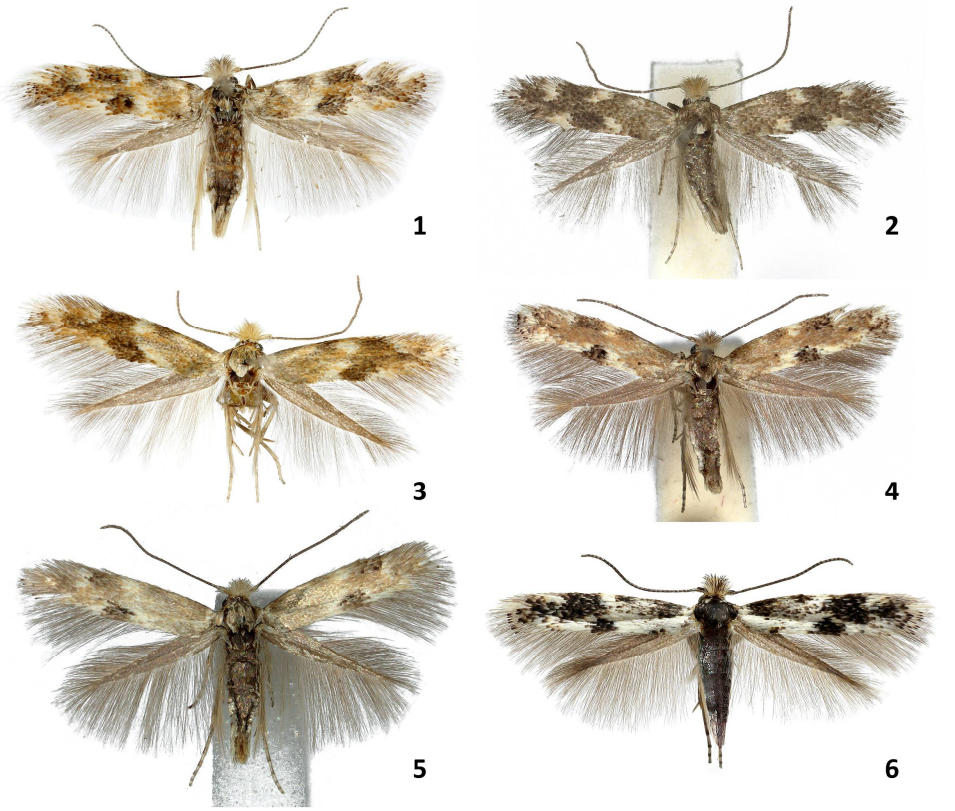
Finland: • Karelia australis, Virolahti, YKJ 671:353, 20 m (60°32'38"N, 27°38'16"E), 28-31.vii.2018, 1♂, DNA sample MM26393, leg. J.-P. Kaitila & P. Kaitila, coll. J.-P. Kaitila.

France: • Centre-Val de Loire, Indre-et-Loire, Bléré, Pelouses de Vezon, 81 m (47°18'29"N, 0°56'46"E), 22.ix.2023, 1 ex., DNA sample CLV46838, leg. & coll. C. Lopez-Vaamonde (INRAE).
Latvia: • Daugavpils, Silene, Ilgas, 160 m (55°41'34"N, 26°47'11"E), 16-20.viii.2001, 1♂ (Gp. ZT 11642), DNA sample MM19451, leg. N. Savenkov, coll. H. Roweck (NHMO).
North Macedonia: • NP Galičica, Dva Topola, 1666 m (40°56'59"N, 20°49'38"E), 3.viii.2023, 1♂ (Gp. ZT 14553), DNA sample TLMF Lep 38651, leg. & coll. Ig. Richter.
Russia: • S-Ural, Chelyabinsk district, Troitsky Nature Reserve near Berlin village, 30.vi.1997, 1♂ (Gp. ZT 10831), DNA sample 19452 (unsuccessful), 1.vii.1997, 1♂ (Gp. ZT 10777), leg. K. Nupponen & J. Junnilainen, coll. J. Junnilainen.
Ukraine: • Odesa Oblast, Kiliya raion, Vylkove, 1 m (45°22'14"N, 29°39'34"E), 8.viii.2016, 1♀ (Gp. 13769 ZT), leg. E. Chalaim, coll. ZMKU.

Description. Adult (Figs 1-3). Wingspan 7.0-8.5 mm. Head: frons white, vertex with ochreous to dark brown scale tufts. Flagellum dark brown with indistinct paler annulation, eye-caps white mixed with dark brown at the apex. Thorax and tegulae dark brown. Forewings of variable colour and pattern. Ground colour white, variably suffused with patches of ochreous to dark brown scales. Markings: two pale spots on costa, one before middle, another at three-quarters, two similar opposite spots on dorsum, lying somewhat closer to base. All four spots more or less inclined distally. In some specimens, these opposite spots almost touch, forming two incomplete fasciae bent towards the apex. Trapezoidal dark brown patches present between costal and dorsal spots (or incomplete fasciae), of which the dorsal patch often contains a cluster of darker scales. Another pale spot present at apex. Scattered dark brown scales situated below this spot towards the apex and forming a ciliary line. Hindwing and cilia of all wings grey. Some darker specimens are almost uniformly brownish grey with more or less distinct pairs of paler costal and dorsal spots.

Male genitalia (Fig. 7). Uncus and gnathos absent. Tegumen broad and relatively short, tapering towards the posterior end. Socii lobes paired, rounded at apex, weakly setose on inner margin. Valva elongate, tapering slightly arcuately distad from apical half of costal margin to a narrow, rounded apex, covered with short stout setae. Vinculum relatively broad, spectacle-like in anterior part. Phallus very long, slender, swollen at base and with sclerotized hook at the distal end. Anellus membranous and evenly tapering.

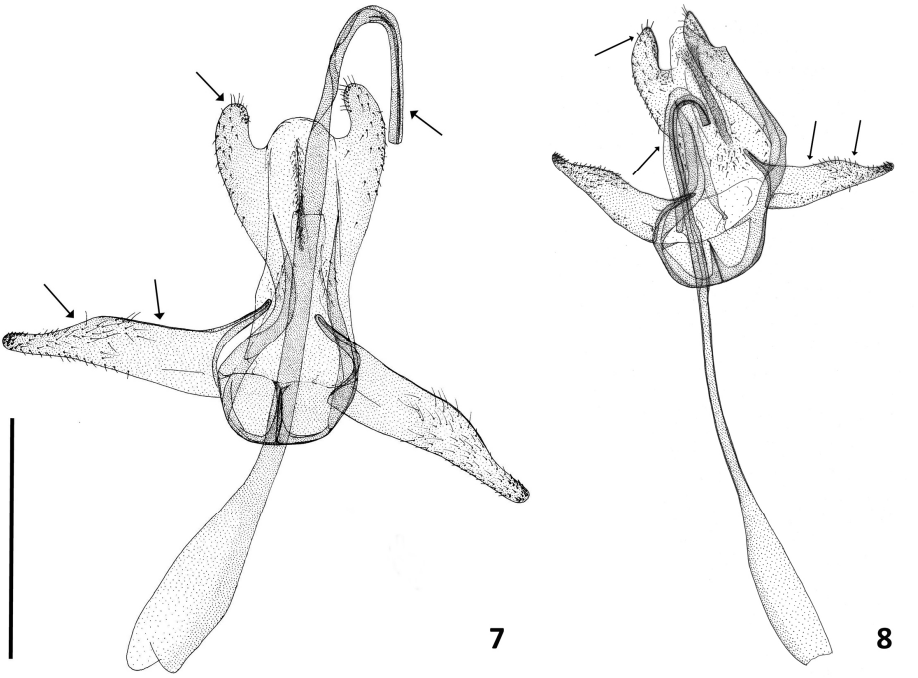
Female genitalia (Fig. 12). Papillae anales relatively broad, covered with scattered bristles. Membrane above papillae anales covered with microtubercles. Apophyses posteriores approximately the same length as segment IX. Lateral lobes of sterigma with setulose structures flanking a circular ostium. Sclerotized part of ductus bursae funnel-shaped, long, slightly tapering towards the membranous, narrow part of the ductus bursae. Length of the sclerotized part of ductus bursae almost equal to combined length of papillae anales and apophyses. Corpus bursae large, oval; signum in the form of spinose ribs with spines of various sizes.



Figures 1-6. Adults of *Bucculatrix*, **1-3.** *B. tanaceti* **sp. nov.**, **1.** Holotype, Slovakia, Michalovce, Biela hora, ex l. 6.x.2022, leg. & coll. Z. Tokár, photo P. Buchner, wingspan 8.0 mm, **2.** Paratype, Slovakia, Pozdišovce, 25.viii.2002, leg. & coll. Z. Tokár, photo A. Tkáč, wingspan 7.8 mm; **3**. Paratype, North Macedonia, NP Galičica, Dva Topola, 1666 m, 3.viii.2023, leg. & coll. Ig. Richter, photo P. Buchner, wingspan 8.4 mm, **4-6.** *B. humiliella*, **4.** Sweden, Ostmark, 4.viii.1979, leg. Bengtsson, coll. Z. Tokár, photo A. Tkáč, wingspan 8.1 mm, **5.** Slovakia, NR Primovské skaly, 10.v.2021, leg. & coll. B. Endel, photo A. Tkáč, wingspan 7.2 mm, **6.** Czechia, NR Brdatka, 8.ix.2005, leg., photo G. Elsner, coll. NMPC, wingspan 8.5 mm.

Diagnosis. The forewings of *B. tanaceti* **sp. nov.** (Figs 1-3) and *B. humiliella* (Figs 4-6) are variable in both colour and pattern; therefore, they are sometimes difficult to distinguish, especially when specimens are worn. The main difference lies in the appearance of the dark dorsal patch between the two pale spots. While in *B. humiliella* this spot is distinct, semi-arched or triangular, and often entirely bordered by pale scales, in *B. tanaceti* the patch is trapezoidal, often containing a cluster of darker scales, but lacking a pale border.

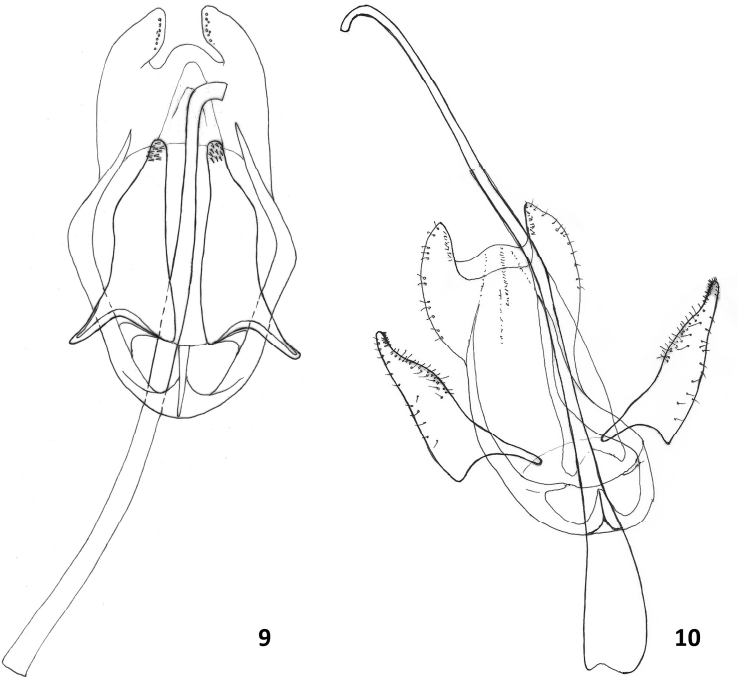
In the male genitalia: the socii are rounded at the apex in *B. tanaceti* (Fig. 7), but more or less tapered at the apex in *B. humiliella* (Fig. 8). The costal margin of the valva in *B. humiliella* is convex in the middle and has a steeper transition to the narrower apical part compared to *B. tanaceti*, in which the same part of the costal margin is straight or only very slightly convex, and the transition to the apical part is more gradual. The hook-like bend of the phallus in *B. humiliella* is either absent or shorter than in *B. tanaceti*.



Figures 7-8. Male genitalia of *Bucculatrix*, **7.** *B. tanaceti* **sp. nov.**, paratype, Slovakia, Michalovce, Biela hora, 30.iii.2002, Gp. ZT 7831, leg. & coll. Z. Tokár, scale bar 0.5 mm. **8.** *B. humiliella*, Finland, Liperi, 5.v.2006, Gp. ZT 11836, leg. & coll. M. Mutanen.

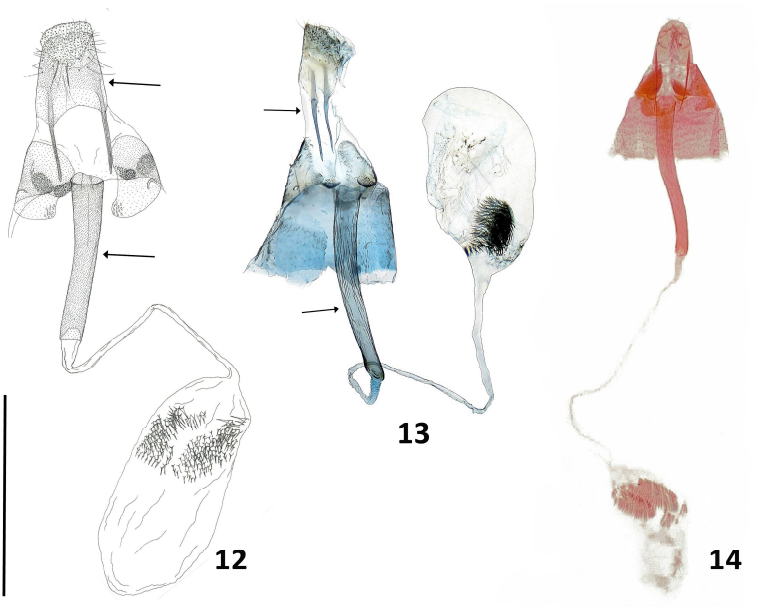
In the female genitalia: *B. humiliella* (Figs 13-15) has a longer sclerotized part of the ductus bursae than *B. tanaceti* (Fig. 12). The species can be best distinguished by measuring the length of this sclerotized part in relation to the combined length of the papillae anales and apophyses. In the examined specimens, this ratio ranged from 0.9 to 1.10 (mean 1.00) in *B. tanaceti*, and from 1.25 to 1.58 (mean 1.40) in *B. humiliella*. However, the female genitalia of *B. tanaceti* closely resemble those of two other species: *B. mehadiensis* Rebel, 1903 (Fig. 16) and *B. clavenae* Klimesch, 1950 (Fig. 17). These two species differ markedly from *B. tanaceti* externally and in the male genitalia. It should be noted that the female genitalia of the latter two species are virtually indistinguishable from each other.

In addition to morphological characters, *B. tanaceti* and *B. humiliella* differ fundamentally in their hostplant association and DNA barcoding results (see below).

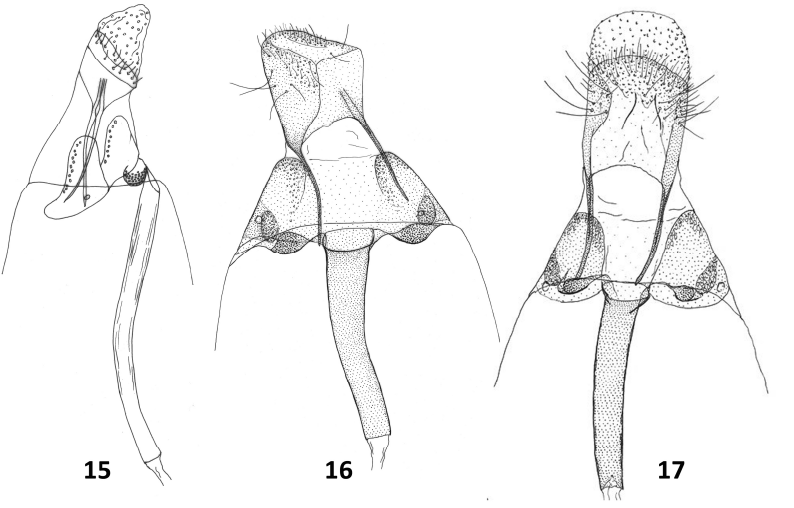


Figures 9-10. Male genitalia of *Bucculatrix humiliella*, **9.** holotype of *B. capreella*, Finland, Punkasalmi, 12.viii.1945, leg. Lindeberg, Gs. No. 7274 & coll. MZH (following KROGERUS, 1952, phallus incomplete), **10.** paratype of B. merei, Great Britain, Scotland, Forres, Morayshire, 13.ix.1966, leg. E. C. Pelham-Clinton, coll. NHMUK (following PELHAM-CLINTON, 1967).

Figure 11. Male genitalia of *Bucculatrix humiliella*, holotype of *B. capreella australis*, France, Cantal, Sainte-Reine, 1050 m, 12.vii.1993, Gs. JN 9102, leg. J. Nel, coll. TLMF, photo P. Huemer.



Figures 12-14. Female genitalia of *Bucculatrix*, **12.** *B. tanaceti*, **sp. nov.**, paratype, Slovakia, Michalovce, Biela hora, 24.vii.2002, Gp. ZT ♀ 7834, leg. & coll. Z. Tokár, scale bar 1.0 mm, **13.** *B. humiliella*, Czechia, NR Brdatka, 8.ix.2005, Gp. 1795, leg. & photo G. Elsner, coll. NMPC, **14.** as *B. obscurella*, Poland, Załubińcze, p. Nowy Sącz, 24.iv.1876, leg. O. Hofmann, Gs. G. Deschka 2194, photo P. Skraba.



Figures 15-17. Female genitalia of *Bucculatrix*, **15.** *Bucculatrix humiliella*, lectotype, Gs. No. 7/97 Mey, coll. ZMB, **16.** *B. mehadiensis*, paralectotype, Romania, Mehadia, 20.vi.1896, Gs. P. 880 Triberti, leg. W. von Hedemann, coll. NHMW, **17.** *B. clavenae*, Austria, Teriol, Larstigalm, el. 1.vii.1949 (*Achillea millefolium*), Gp. ZT 10138, leg. K. Burmann, coll. TLMF.

Distribution. *Bucculatrix tanaceti* **sp. nov.** is currently known from scattered localities ranging from central France through central Europe to southern Finland and the Baltic States in the north-east, the Southern Ural in the east, and the Balkans in the south-east.

In addition to the countries listed in the taxonomy section (Austria, Bulgaria, Czechia, Finland, France, Latvia, North Macedonia, Russia, Slovakia, and Ukraine), it undoubtedly occurs in Germany (Saxony, Dübener Heide near Doberschütz, leg. H. Melzer, under *B. humiliella* (Lepiforum 2026)) and Hungary (KLIMESCH (1956): Kis-Balaton area near Vörs; and very probably also FAZEKAS et al. (2012): Dombóvár, Gunaras, under *B. humiliella*).

The species has been recorded from sea level (Finland: Virolahti) up to an elevation of more than 1600 m (North Macedonia: Galičica Karst).

Biology. *Bucculatrix tanaceti* **sp. nov.** is trophically associated with *Tanacetum vulgare*, distinguishing it from *B. humiliella*, which feeds on *Achillea millefolium* L. (both host-plants belong to the family Asteraceae).

Despite several years of intensive searching on *Tanacetum vulgare*, larvae remain difficult to locate. Although numerous vacated mines were recorded (e.g. Fig. 18) at the type locality (Biela hora near Michalovce), only two larvae were successfully collected. Both were found on 10 September (in 2020 and 2022, respectively). The larva collected in 2020 pupated shortly after collection, and the

Figure 18. Mines on *Tanacetum vulgare*, Slovakia, Michalovce, Biela hora, photographed on 26.ix.2023.

adult emerged on 27 September 2020. The larva collected in 2022 reached the adult stage on 6 October 2022 (designated as the holotype). Due to the limited material and rapid pupation in captivity, a detailed morphological examination of the larvae could not be conducted and remains a subject for future research. Figures 19-21 illustrate a larva collected on 10 September 2022, its subsequent formation of a moulting cocoon, and the characteristic ribbed pupal cocoon with the protruded pupal exuvia.

Figures 19-21. Preimaginal stages of *Bucculatrix tanaceti* sp. nov., **19.** Larva on a *Tanacetum vulgare* leaf, **20.** Final instar larva within an opened moulting cocoon spun on the leaf, Slovakia, Michalovce, Biela hora, photographed on 10.ix.2022 and 17.ix.2022. Photos Z. Tokár, **21.** The cocoon with the protruded pupa, Michalovce, Biela hora, el. 6.x.2022, leg. Z. Tokár, photo P. Buchner.

Historically, KLIMESCH (1956) obtained an adult of a species he identified as "*Bucculatrix* near *fatigatella*" from a single larva found on *Tanacetum vulgare* in Upper Austria (near Rottenegg, Rödl River valley) on 31 July 1948 (the adult emerged on 16 August 1948). KLIMESCH (1990) later elaborated on these observations: "The mines are bilateral, glassy, approximately 1–5 mm long and 0.2–0.5 mm wide, located on the leaf margins, arising from lateral incisions of the leaf. The young mine is small, inconspicuous, and apparently bilateral, with a short frass trail at the beginning. The moulting cocoon is dense, whitish, and spans the width of the leaf segment; the pupal cocoon is white."

Further observations of the larvae on *Tanacetum vulgare* by H. Melzer (Lepiforum 2026, under *B. humiliella*) provide, in translation, additional details: "The larva initially functions as a leaf miner. The mine eventually occupies nearly the entire leaf lobe and is characterized by a thin, central black line of frass. After vacating the mine, the larva constructs a conspicuous, rounded, white moulting cocoon on the upper surface of the leaf for its final moult. Subsequently, it lives freely on the upper leaf surface until pupation, feeding exclusively on the upper

epidermis. This results in characteristic brownish patches on the leaf lobes. During this brief period, larvae can be collected from the leaf surfaces, occasionally in significant numbers. For pupation, the larva constructs a ribbed cocoon on the host plant."

These documented observations clearly correspond to the life cycle of *Bucculatrix tanaceti* **sp. nov.**

Adults have been recorded from late March to late November in two generations, with the second generation overwintering. Most specimens were collected using light traps, while others were flushed from the host-plant or surrounding vegetation before sunset. The moth thrives in salt marshes, unkempt gardens, or on river embankments. The type locality Biela hora near Michalovce (Fig. 22) represents an area of unmowed meadows in forest park clearings and on an unmaintained former military training ground.

Figure 22. Type locality of *Bucculatrix tanaceti*, **sp. nov.**, Michalovce, Biela hora.

Etymology. The specific name *tanaceti*, a noun in the genitive case, is derived from *Tanacetum vulgare*, the host-plant of the larvae of the new species.

Molecular data (Fig. 23). The DNA barcoded specimens form a unique BIN: BOLD:AAU1881. Fourteen specimens of the new species have been successfully sequenced, listed here by their sample IDs: MM19450, MM19451, MM19481, MM26393, TLMF Lep 26470, TLMF Lep 38648, TLMF Lep 38651, KLM Lep 14324,

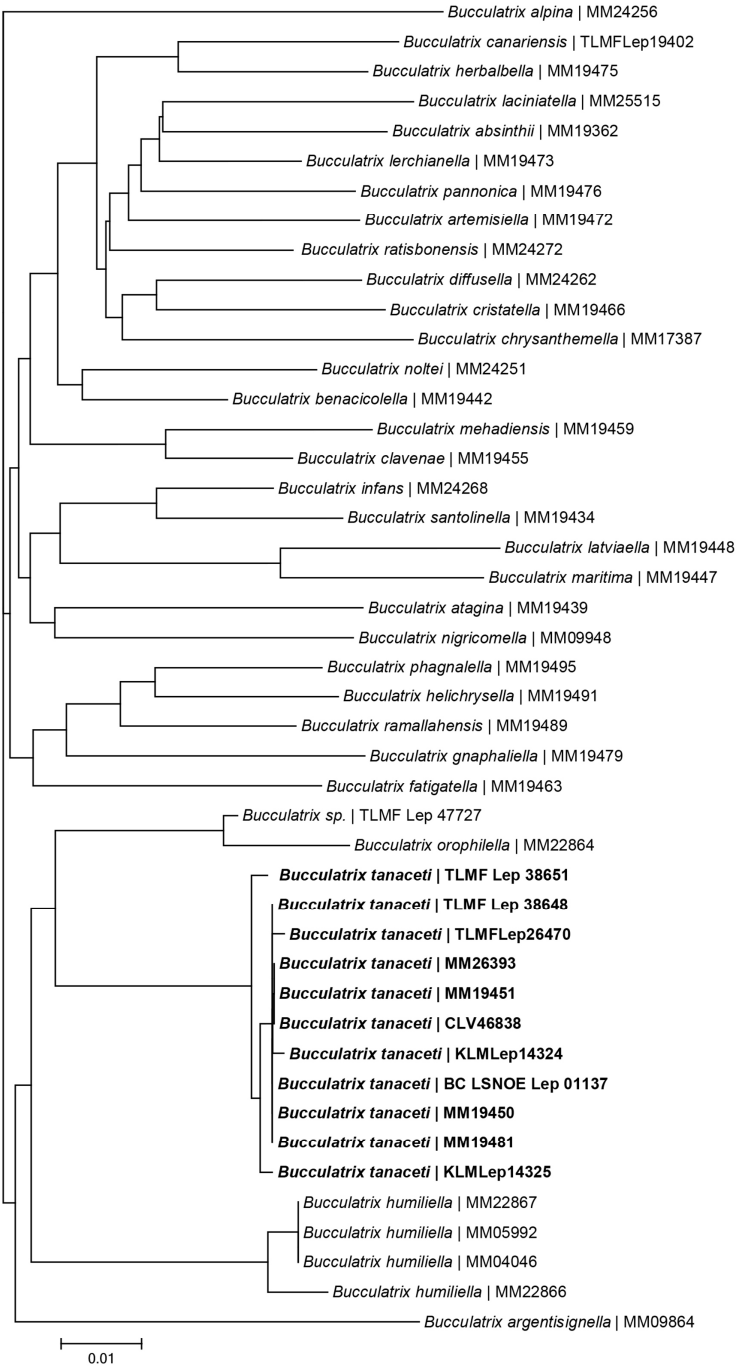


Figure 23. A Neighbor-joining tree of *Bucculatrix tanaceti* (shown in bold type) and selected closely related species based on COI sequences. Scale bar represents 1 % K2P genetic divergence between sequences.

KLM Lep 14325, KLM Lep 15515, KLM Lep 15517, KLM Lep 16312, BC LSNOE Lep 01137, and CLV46838 (3 specimens were not included in the Neighbor-joining tree). Details regarding the collecting site and sequences are provided above in the text. Additional data are accessible via the public dataset DS-BUCCNEW "New *Bucculatrix* species" (dx.doi.org/10.5883/DS-BUCCNEW). DNA barcoding results reveal a significant genetic divergence between *Bucculatrix tanaceti* sp. nov. and *B. humiliella*, confirming their status as distinct species. The minimum p-distance to the closest BIN (*Bucculatrix* sp. from Armenia, DNA sample TLMF Lep 47727) is 4.71%.

B. humiliella and species synonymous with *B. humiliella*

Figs 4-6, 8-11, 13-15

Due to the high similarity between *B. tanaceti* sp. nov. and *B. humiliella*, all species names currently considered synonymous with *B. humiliella* were re-examined to exclude the possibility that the new species had already been described in the past.

Bucculatrix humiliella Herrich-Schäffer, [1855]

Bucculatrix humiliella Herrich-Schäffer, [1855]. *Systematische Bearbeitung der Schmetterlinge von Europa* 5: 340.

Examined type material (genitalia slides): Lectotype ♀ (Fig. 15), without locality and date, leg. (?) Herrich-Schäffer, 7/97 Mey, ex coll. Staudinger, coll. ZMB; paratype ♂, without locality and date, leg. (?) Herrich-Schäffer, 9/97 Mey, ex coll. Staudinger, coll. ZMB.

Bucculatrix obscurella Klemensiewicz, 1899

Bucculatrix fatigatella var. obscurella Klemensiewicz, 1899. *Sprawozdania Komisyi fizyograficznej* 34 (suppl.): 199-200. Synonymized by Mey (1999).

Examined material (photographs of adults and genitalia slides): Poland, Załubińcze, p. Nowy Sącz, 24.iv.1876, ♀, leg. O. Hof. [Ottmar Hofmann], Euparal-Präp. Nr. G. Deschka 2194 (Fig. 14); Nowy Sącz, 2.vi.1881, ♂, ex coll. Klemensiewicz, coll. ISEZ PAN.

The syntypes of this taxon have not been formally designated.

The forewings on the photographed specimens are characterized by a blackish-brown ground colour with a white, low, convex arch in the middle of the dorsum, enclosing a triangular, distinctly black spot. This corresponds well to one of the dark forms of *B. humiliella* that exhibits a predominantly monotonous forewing coloration.

Bucculatrix capreella Krogerus, 1952

Bucculatrix capreella Krogerus, 1952. *Notulae Entomologicae* 32: 157-158.
Synonymized by Deschka (1992).

Examined type material: Holotype ♂ (Fig. 9), Finland, Punkasalmi, 12.viii.1945, leg. Lindeberg, genitalia slide No. 7274 Museum Helsinki; allotype ♀, Finland, Al Finström, Åttböle, 3.vi.1945, leg. A. Nordman, genitalia preparation No. 7275 Museum Helsinki (Gs. ZT 13782); paratype No. 1 ♂, Finland, Sääksmäki, leg. Kivirikko, coll. MZH.

Examination of these genital preparations confirmed the conspecificity of *B. capreella* with *B. humiliella*.

Bucculatrix merei Pelham-Clinton, 1967

Bucculatrix merei Pelham-Clinton, 1967, *Entomologist's Gazette* 18: 155-158, figs 1-3.
Synonymized by SVENSSON (1971), indirectly as a synonym of *B. capreella*.

The type material was not examined. However, Pelham-Clinton provided a highly detailed description of the species, complete with photographs of all adult type specimens and line drawings of the male and female genitalia. These characters clearly demonstrate that *B. merei* is identical to *B. humiliella*. A reproduction of the drawing of the paratype male genitalia is presented in Figure 10.

Bucculatrix capreella australis Nel, 1999, **syn. nov.**

Bucculatrix capreella australis Nel, 1999, *Bulletin de la Société entomologique de France* 104: 348-350, Figs 3, 6A, 7A.

Examined type material (photographs of genitalia slides): Holotype ♂ (Fig. 11), France, Cantal, Sainte-Reine, 1050 m, 12.vii.1993, leg. J. Nel, JN 9102; allotype ♀, France, Lozère, Paulhac-en-Margeride, 1300 m, 15.vii.1997, leg. J. Nel, JN 5885, coll. TLMF.

Examination of these preparations confirmed that *B. capreella australis* is a junior subjective synonym of *B. humiliella*.

Remarks

The taxonomy of *Bucculatrix* remains poorly understood globally. Even in areas where the Lepidoptera fauna is considered well-documented, new species continue to be discovered, largely driven by the significant contributions of DNA barcoding. This is exemplified by *B. tanaceti* **sp. nov.**, which was further differentiated based on the knowledge of its larval host- plant. As outlined in the introduction, the new species belongs to the large *B. gnaphaliella* group, whose members have evolutionarily specialized predominantly on flowering plants within the family Asteraceae.

Within this and other *Bucculatrix* species-groups, numerous closely related taxa exist that are morphologically difficult to distinguish. In addition to analysing DNA barcode clusters, a thorough knowledge of the biology of the preimaginal stages remains essential and would significantly facilitate the identification of cryptic species. Within Europe, additional undescribed species are expected to be discovered primarily in the Mediterranean region, as well as on the Iberian and Balkan Peninsulas.

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