First early-stage observations for *Tenaga* Clemens, 1862 with notes on biology and distribution of *T. nigripunctella* (Haworth, 1828) (Lepidoptera, Tineidae)

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Abstract. Early stages of the tineid genus *Tenaga* Clemens, 1862 are reported for the first time, for *T. nigripunctella* (Haworth, 1828). Its larvae were found within the shells of dead Garden Snails *Cornu aspersum* (Müller, 1774), feeding on the dried body tissues. Larvae of the moth have been found, but not reared, among a range of detritus substrates, with traces of likely feeding observed on dry mouse droppings, and in a dead Western Honeybee *Apis mellifera* Linnaeus, 1758. Adults of the species have been seen annually since 2013 in a small area of Dorset, England. Historical and modern occurrences in Great Britain (until 1934) and country records elsewhere are reviewed, with new records reported for Lebanon and Syria. Two live larvae have been found within dead snail shells, one reared to the adult stage, the other was identified from its DNA barcode. Only a single COI-5P haplotype is known worldwide and ours is the fourth known DNA sequence. The taxonomic placement of the genus *Tenaga*, containing only two closely related species, sometimes placed in the family Meessiidae, is also discussed.

Introduction

Tenaga Clemens, 1862 comprises two small tineid species with hitherto unknown biology. One of these, *Tenaga nigripunctella* (Haworth, 1828) is a species which historically experienced a few temporarily established introductions worldwide that were even treated as different taxa, and which is considered generally to be rare (Robinson and Nielsen 1983). Here we review country records for its worldwide distribution, including all its synonyms, and focus on the first early stage and biological observations from Great Britain.

For much of the past century *T. nigripunctella* was thought to be extinct in Great Britain and Ireland (Pelham-Clinton 1985: 161), the last British example having been found in 1934. There, the moth was historically recorded from Kent to Cornwall and north to Cheshire and Yorkshire, and doubtfully in Northumberland and Ireland (Birchall, 1866: 147, as '*T*[*inea*]. *confusella*'; Beirne 1941: 129, Pelham-Clinton 1985) as well as in Channel Islands (Jersey: St Helier) in 1886 (Jordan 1888: 50). In Dorset, the species had been recorded widely in the eastern half of the county, mainly in the 19th century, at Glanvilles Wootton, Higher Bockhampton, Winfrith, Bloxworth, Portland, Corfe Castle and Studland (Curtis [1967]), and Isle of Purbeck (Bankes, 1895). *Tenaga nigripunctella* was last recorded in Great Britain at Dymchurch by L.T. Ford in 1934. The species did not turn up again until 9.viii.2013, when a single adult specimen was found by Rachel Terry at East Creech Farm, Dorset (Langmaid and Young 2014), confirming the continued presence of this species in Great Britain. This specimen was dissected to examine the genitalia (R. Terry, pers. comm.), confirming it was this species and not the superficially identical European species *T. rhenania*.

Its distribution in Europe is also limited, being recorded in Madeira and Azores (Portugal), Canaries and N. Spain (Spain), France, Germany, Netherlands, Italy (?), Croatia (Bakar, in house, 23 July 1956), Greece, Poland (Gaedike and Falck 2015; Gaedike 2019; Lepiforum 2024). Elsewhere, Gaedike (2019: 69) recorded it from Turkey and Israel (these records were verified by dissection: R. Gaedike pers. comm) and it is known from Ukraine/Crimea and Morocco, North Africa (Stainton 1872: 233; Petersen 1963; Gaedike 2009a, b; Lepiforum 2024). Records from other European countries (Austria, Switzerland, Bulgaria, Romania) possibly represent misidentifications referable to *T. rhenania* (Petersen, 1962) (Lepiforum 2024; see e.g. Kovács and Kovács 2023). In any case, on BOLD (accessed on 21.vi.2024), a partial DNA barcode of an individual from Italy (Trentino: Val Sarca, Pietramurata; USNMENT01568000) represents a clear misidentification belonging to *T. rhenania*. On BOLD there is a partial DNA barcode belonging to *T. nigripunctella* from Croatia (Process ID LNAUY545-19, specimen USNMENT01568000) as well as a full one from Georgia: Tbilisi (Process ID TIPSY848-15, specimen TJ0089). There is also a partial DNA barcode record (408 bp) for *T. nigripunctella* from a specimen collected by Annette F. Braun (USNMENT01523607) in the United States (Ohio: Hamilton County, Cincinnati); the sequence for another specimen from there (USNMENT01523608) is likely contaminated. The species has been recorded from Australia, as *Macraeola linobola* Meyrick, 1893, a junior synonym of *T. nigripunctella*: New South Wales (Sydney, Paramatta and Hexham; five examples were collected at these localities between 1879 and 1885); it is now thought to be possibly extinct in Australia (Robinson and Nielsen 1993: 77). *T. nigripunctella* has also been recorded in South Africa (Cape Town, three syntypes), as *Tinea sesquitertia* Meyrick, 1909 (Robinson and Nielsen 1993: 77).

Until recently it was not clear that the genus *Tenaga* Clemens, 1862 persists in Great Britain. An American taxon *Tenaga pomiliella* Clemens, 1862, the type species of the genus, had been recorded by H.W. Daltry from Deal, Kent in 1928 (Daltry 1929) and in 1930 (Daltry 1931). These specimens were neither located nor re-examined, according to Pelham-Clinton (1985: 162). A DNA sequence fragment (as "*T. pomiliella*" on BOLD: Specimen USNMENT01048232; Process ID LNAUT3709-15) from Texas can be ignored as it apparently represents a contamination of an *Argyresthia alternatella* Kearfott, 1908. In USA, *T. pomiliella* has also been recorded from Pennsylvania (Dietz 1905). However, *Tenaga pomiliella* Clemens, 1862 was synonymised with *T. nigripunctella* by Robinson and Nielsen (1993: 77), as was *M. linobola* Meyrick, 1893 from New South Wales, Australia, and *T. sesquitertia* Meyrick, 1909, described from Cape Town, South Africa, while *Tinea moeniella* Rössler, 1877 from N. Spain (Bilbao) was also synonymised with *T. nigripunctella* by Petersen (1983). Until this study, there were no DNA barcodes of *T. nigripunctella* from Great Britain and on BOLD (21.vi.2024) only the above two genuine records (from USA and Croatia) were publicly available, as well as the private one from Georgia. The valid DNA barcode for Braun's record from Cincinnati shares an identical haplotype (across 408 bp in common) with all these sequences.

We are unaware of confirmed observations of the early stages of *T. nigripunctella*. Pelham-Clinton (1985:161) states that 'Continental authors have reported that it feeds in a portable case on lichens on fences, but this seems unlikely'. The situation is reviewed by Gaedike (2015: 78–79); he suggests the reference to lichen as a pabulum is based on Spuler (1910), and that these observations refer almost certainly to the larva and habits of *Eumasia parietariella* (Heydenreich, 1851) (Psychidae). There are also detailed larval and case descriptions by von Heyden (1861), quoted on Lepiforum (2024), not explicitly reviewed in Gaedike, that may also refer to *E. parietariella*. Adults of *E. parietariella* are superficially like *T. nigripunctella* but have much shorter antennae, whereas, for example, the tineine moth *Proterospastis merdella* (Zeller, 1852) has very similar wing pattern and antennal length (see https://lepiforum.org/wiki/page/Proterospastis_Merdella).

Reference to possible haunts of the larva have been inferred from habits of the adult. Gaedike (2015) suggests that it may feed within the nests of rodents as the number of adult moths appears to rise in tandem with infestations of rats. The original observation was by Annette Braun (quoted by Daltry 1929). Moth appearances appeared correlated with rat outbreaks in her Cincinnati house, where she sampled 28 individuals between 1905 and 1928, and observed the adults "throughout the summer from 1st of June to the end of September with not more than a week's interval between any two dates", usually "resting on the outside of my house". Pelham-Clinton (1985: 161) quotes Barrett (1878), "At Tenby I have found it sitting on a house door, where it occurs rather frequently; but, from the description of building which it principally frequents – here and elsewhere – its larva may be suspected of tastes and habits which can hardly be described as decent, much less fastidious". There is a similar comment by R. McLachlan, "More than thirty years ago I found several examples of *Tenaga nigripunctella* in the "retreat" of a house at Folkestone [England] at which I was lodging." This is in a footnote to Walsingham (1894: 50) which added the species to the Norfolk list. We can infer that the moths' favoured haunts were toilets, which could also fit with a rodent-nest life history. There are other references to the moth being associated with out-houses by Stainton (1863) (in Clerkenwell) and Bankes (1895: 126, 129) (in Isle of Purbeck), the former where ducks were kept.

Not only was the early-stage biology unknown, but the taxonomic position of the genus *Tenaga* within superfamily Tineoidea has been debated. In some works, the genus is retained in family Tineidae, subfamily Meessiinae (e.g. Gaedike et al. 2015; Agassiz et al. 2024). However, Meessiidae has quite recently been elevated to family status (Regier et al. 2015). Gaedike (2019: xviii, 236–239) and Gaedike and Falck (2019) treated Meessiidae as a family. This included for the European fauna the following genera as well as *Tenaga*: *Agnathosia* Amsel, 1954, *Eudarcia* Clemens, 1860, *Infurcitinea* Spuler, 1910, *Ischnoscia* Meyrick, 1895, *Karsholtia* Gaedike, 1986, *Lichenotinea* Petersen, 1957, *Matratinea* Sziráki, 1990, *Novotinea* Amsel, 1938, *Stenoptinea* Dietz, 1905, and *Xystrologa* Meyrick, 1919. It is not the case, though, that all former Meessiinae (35 genera and 248 species listed in Robinson, 2009) should belong to Meessiidae. Regier et al. (2015), from the results of (albeit very limited) generic sampling of Tineoidea among their 19 gene nuclear dataset, included in Meessiidae only the American monotypic genus *Bathroxena* Meyrick, 1919 and *Eudarcia* Clemens, 1860, but they did not sample any of the above other European genera apart from *Xystrologa* which falls in Tineidae. In Great Britain, *Eudarcia* contains a single species in Great Britain, *E. richardsoni* (Walsingham, 1900), found only in Dorset, formerly considered endemic but now known from Switzerland and Croatia (see https://lepiforum.org/wiki/page/Eudarcia_richardsoni), and so it is the only molecularly acknowledged British meessiid, although morphologically *Infurcitinea* has previously been considered to be the sister group of *Eudarcia* (as its synonyms, *Meessia* Hofmann, 1898 and *Obesoceras* Petersen, 1957: Gaedike 1985; Robinson and Nielsen 1993: 69). Regier et al. (2015: 409–432) do not include *Infurcitinea* but provide a morphological diagnosis of Meessiidae (*sensu stricto*) including its larval synapomorphies and biology with larval cases on crustose lichens. Robinson and Nielsen (1993: 73–77) treat the morphology *of T. nigripunctella* in detail, comparing *Tenaga* in their diagnosis only to *Eudarcia* (see also Robinson and Nielsen: 67–69). However, the last authors position *Tenaga* just before *Oenoe* Chambers, 1874, a genus placed, according to the nuclear gene results of Regier et al. (2015), in the Tineidae ('Tineine lineage', 'Clade B') along with *Homosetia* Clemens, 1863. This last genus is related to *Stenoptinea* and had also been placed in the "meessiine" tribe Celesticini Capuse, 1971 (Robinson and Nielsen: 82); furthermore, *Homosetia* may be closely related to *Stenoptinea* according to Neighbor Joining results for DNA barcodes on BOLD. *Tenaga* also contains only otherwise *T. rhenania* (Petersen, 1962), a species whose biology also has remained obscure, but is also known to have a penchant for dry stone walls (Hausenblas 2019).

Here we document further records of *T. nigripunctella* and the first verifiable records of its biology and adult behaviour, the first DNA barcode for a UK specimen, and we also discuss taxonomic placement of the genus *Tenaga*.

Abbreviations

BIN – Barcode Index Number

BOLD – Barcode of Life Database

MNHN – Museum National d'Histoire Naturelle, Paris

MZF – Finnish Museum of Natural History, Helsinki, Finland

NHMUK – Natural History Museum, London

Materials and methods

Genomic DNA from a dead larva (NHMUK013700379) was extracted using standard Sanger protocols set out in Sterling et al. (2022), using primers HCO2198, LCO1490 (Folmer et al. 1994) and the Hebert primers Lep-F1, Lep-R1. A 658 basepair (bp) DNA barcode was obtained using Oxford Nanopore Technologies (ONT) SQK-lSK110 ligation kit and a 200-pore ONT Flongle flow cell (r9.4.1, Flo-Flg001) fitted to a GridIon X5 benchtop sequencing machine, and assembled using ONT barcoder (for more details, see Sterling et al. 2023). The sequence is released as GenBank accession PP391031 (Process ID UKMOT013-24).

Results

DNA barcoding

The DNA barcode of the dead larva is identical to a DNA barcode (based on specimen number TJ0089 from Georgia belonging to the BIN BOLD: BOLD:ACV3329), verifying the species identity as *Tenaga nigripunctella*; the sequence also does not differ to those from two additional specimens mentioned above from Croatia (USNMENT01568000) and USA (USNMENT01523607) It is 7.37% pairwise divergent (based on a 658 bp barcode) to two sequences (specimen numbers TLMF Lep 25694, BC_LS-NOE_Lep_03377) of *T. rhenania* from France and Austria (belonging to BIN BOLD:ADN6768).

Additional records of *Tenaga nigripunctella*

There are few recent records of *T. nigripunctella* outside Europe but there is a male of *T. nigripunctella* in MZF from Lebanon (Koura, Beshmazzine) in on 3.vi.2012, leg. J. Kullberg & T. Lievenon and there is a female from "Syrie" [Syria, undated] in MNHN (R. Gaedike pers. comm. to DCL). In Europe the NHMUK holdings (see Material examined) document its prior distribution in Great Britain not only from Dorset up to the late 1890s and also from Middlesex, Surrey (1873), Wiltshire

(1890s) West Sussex (1880s), in Northern Ireland in Eire (Dublin) at least in the 1860s, Kent (1834) and in the Channel Islands (1886), as well as Portugal (Madeira) There are also specimens from Jersey, Channel Islands (1886). Since then, the species has been recorded annually between 2014 and 2024, 40 km to the west of the example in 2013, at one coastal and two inland locations in Dorset.

Material examined (in NHMUK with locality or temporal data; [single specimens unless otherwise reported between squared brackets]). Great Britain: LT #M of *Tinea nigripunctella* Haw. 43 54 [round blue label]; London [Stephens/Stainton coll.]: Lewisham July 17th, 1853, St[ainto]n; London Aug. 2nd, 1853; London, Eaton Square, m[id].VII.1895, W[a]ls[ingha]m; Middlesex [S.N.A. Jacobs coll.: ex coll. W. F[assnidge]: Chiswick, 6.7.00, 28.vii.1918; Kent [L.T. Ford coll.]: Dymchurch 14.iii.[19]34, L.T. Ford, in house; Surrey: [Weybridge], Oatlands Park Hotel, Hauser, 20/7/[18]73; East Sussex [E.R. Bankes coll.]: Brighton vii-viii [18]95 [7]; West Sussex [John Simpson Tyerman coll./E.R. Bankes coll.]: Worthing, c. 1883; Worthing W.F.A. 22.7.86 [2]; Worthing W.B.F. [18]91 [2]; Dorset [E.R. Bankes coll.]: Corfe [sic, now Corfe Castle]: 29.6.[18]83; 22.7.[18]84 [2]; 3.8.[18]84; 10.8.[18]84; 14.8.[18]84 [2]; 21.4.[18]87; 3.8.[18]87; 2.4.[18]89; 3.4.[18]89, 6.4.[18]89; 23.4.[18]89; 25.6.[18]89; 26.6.[18]89; 28.6.[18]89 [2]; 24.6.[18]90; 13.8.[18]90; 14.4.[18]93; 22.4.[18]91; 29.5.[18]93; 20.6.[18]93; 21.6.[18]93; 22.6.[18]93; 18.7.[18]94; 16.8.[18]97, 13.8. [18]98, 6.4.[18]99; 13.6.[18]99; Corfe C[astle]. 1.4.[18]94; 4.4.[18]95; 28.4.[18]95; 30.7.[18]94 (2); Bloxworth A.P. Bambridge [18]95; 4.7.[18]95; Wiltshire [E.R. Bankes coll.]: Salisbury 15.7.[18]99; 18.7.[18]99; 6.8.[18]99; Eire ?: C.G. B[arrett] 26.10.[18]83; Channel Is.: C.I. Jersey 21–28.viii. 1886 R.C.R. Jordan, E.M.M.25:49–52; Portugal: Madeira, Wollaston, B. Baker Coll. (2); France: S. France Cote d 'Azure J.C. Warburg B.M. 1932–64 29/5/[18]90 [1 #M] ; B.P. [=Basses Pyrénées], St. Pierre d'Aube 10.5. 1937 (1), 15.5.1987 (1), 16.5.1937 (1), 18.5.1937, 24.5.1937, 7.6.1937, 21.8.1937, G.T. Adkin; Auglet 31.5.1938; Mouguerre 11.vi. 1937, all G.T. Adkin; Pyr[énées]. Or[ientales], Thuès-Les-Bains, 24.VI.1900 Wals[ingha]m; Germany: Nassau, Staudinger 1/[18]81 [3], 7.1.[18]90 [2], 1/[18]51; Bornich, 27.6.[18]96, [18]96, 21/7/[18]98, Klisgen [?] 6.8.[18]75, Riesling lg. [4]; Spain: Prov. Granada, Valley of Rio Guadaifeo, South side, E. of Orgiva, 29.vi.1968, B.M. Genitalia slide 10,031; Italy: Reggio – Em[ilia] 1.viii.[19]19 [no abdomen, 1088, det. G. Petersen 1979]; North Africa: Morocco, Tangier 8.v.1902 Wlsm. 87866 Slide 8227; Morocco, Tangier 10.iv.1870, T. Blackmore, H.T. Stainton det., Ent.Mon. Mag. 8:233 (1872); USA: Cincinnati O[hio]., Annette F. Braun, vii.10 [19]09, vii.27 [19]16 [2 #M, as *T. pomiliella*]; Australia: NHMUK010921841, N.S. Wales Sydney 5.3.[18]85, LT #M of *Macraeola linobola* Meyr., genitalia slide 10058; same locality, 21.2.[18]78, PLT #M of *Macraeola linobola* Meyr. [1]; same locality 17.3.[18]79, PLT #F of *Macraeola linobola* Meyr., B.M. slide 10055W [, wing prep.]; N.S. Wales, Paramatta 22.i.1879 Raynot [1, as *altiliella*] ; N.S. Wales, Hexham, 1878 Raynot [1]; South Africa: Cape Town, Cape Colony 8.[19]18, B,M. slide 10,309 as *Tinea sesquitertia* Meyr.; Cape Town, Cape Colony L[ate?]. [18]86, PLT *Tinea sesquitertia* Meyr.; No locality data [as *Tinea sesquitertia* Meyr.], Fuchs, 12/[18]77–3/80 [15].

Biology and early stages of *Tenaga nigripunctella*. *Adult behaviour*. Most adults in Great Britain have been found by day at rest on timber and spiders' webs in garden sheds, or flying in and around unheated outbuildings by day, and one has been found in a moth trap. In 2023 several adults were observed between 19.vi and 6.vii flying close to stone walls, including a dry-stone wall and a mortared wall. On 5.vii.2023, an adult was seen flying close to a small hole in the mortared wall with two more apparently fresh adults sitting at the entrance to the same hole, suggesting these adults might have emerged from pupae within that hole; there was also a large snail shell visible at the entrance (see Fig. 1A). The hole in the wall was no deeper than 15 cm. Another adult was also found at rest inside a different small hole in the mortared wall.

According to records in NHMUK and our own, the adult flight period is from early April until end of August, and there appears to be a protracted emergence period. The adult rests characteristically in an inclining posture at about 30°, raised up on extended forelegs and midlegs (see Fig. 1B, C) and can negotiate spider webs (Fig. 1D). When disturbed the antennae wave alternately back and forth almost continually (Fig. 1C), and are exceptionally long, longer than the length of the forewing (4–4.5 mm).

Figure 1. Adults of *Tenaga nigripunctella* from Abbotsbury Swannery. **A.** Two adults (white arrows) close to a dead *Cornu aspersum* snail in a hole in a stone wall, 5.vii.2023, photo Joe Stockwell; **B.** Female, reared from pupa, collected 5.vii.2024, emerged 6.vii.2024, photo Phil Sterling; **C.** Male, 5. vii.2023, photo Joe Stockwell; **D.** Adult resting on silk threads, 8.vii.2023, photo Jack Oughton.

***Egg*.** Unknown.

***Larva*.** Final instar (based on two confirmed and four likely examples). Head translucent pale brown or orangey brown, mouthparts darker brown. Prothoracic plate translucent yellowish brown or yellowish. Body colour translucent whitish or cream-coloured, sometimes tinged yellowish, with dark gut contents often visible within the body; setae whitish and long, approximately the diameter of the body. Thoracic legs translucent yellowish, tarsi sometimes darker brown, prolegs as body colour. Anal plate translucent yellowish brown or cream coloured (see Fig. 2A). It is clear that the description of the larva and larval case by von Heyden (1861), quoted on Lepiforum (2024) refers to a different species than *T. nigripunctella*.

***Larval feeding and habits*.** On seven occasions larval frass has been observed within the shells of dead snails, two identified as *Cornu aspersum*, five as White-lipped Snail *Cepaea hortensis* (Müller, 1774). Shells were lying on ledges, a windowsill, and one *Cornu* shell within the hole in the wall (see Fig. 1A). Each of the two *Cornu* shells contained a living larva, one of which was reared to an adult, the other died and its identity was confirmed from its DNA barcode (see Fig. 2B). To find the larva, the *Cornu* shells were carefully cut open, and in one instance, the top of the shell removed, revealing the larva in both cases close to the centre of the shell, and silk and frass distributed within (Fig. 2B, E). No larvae were found within the five *Cepaea* shells.

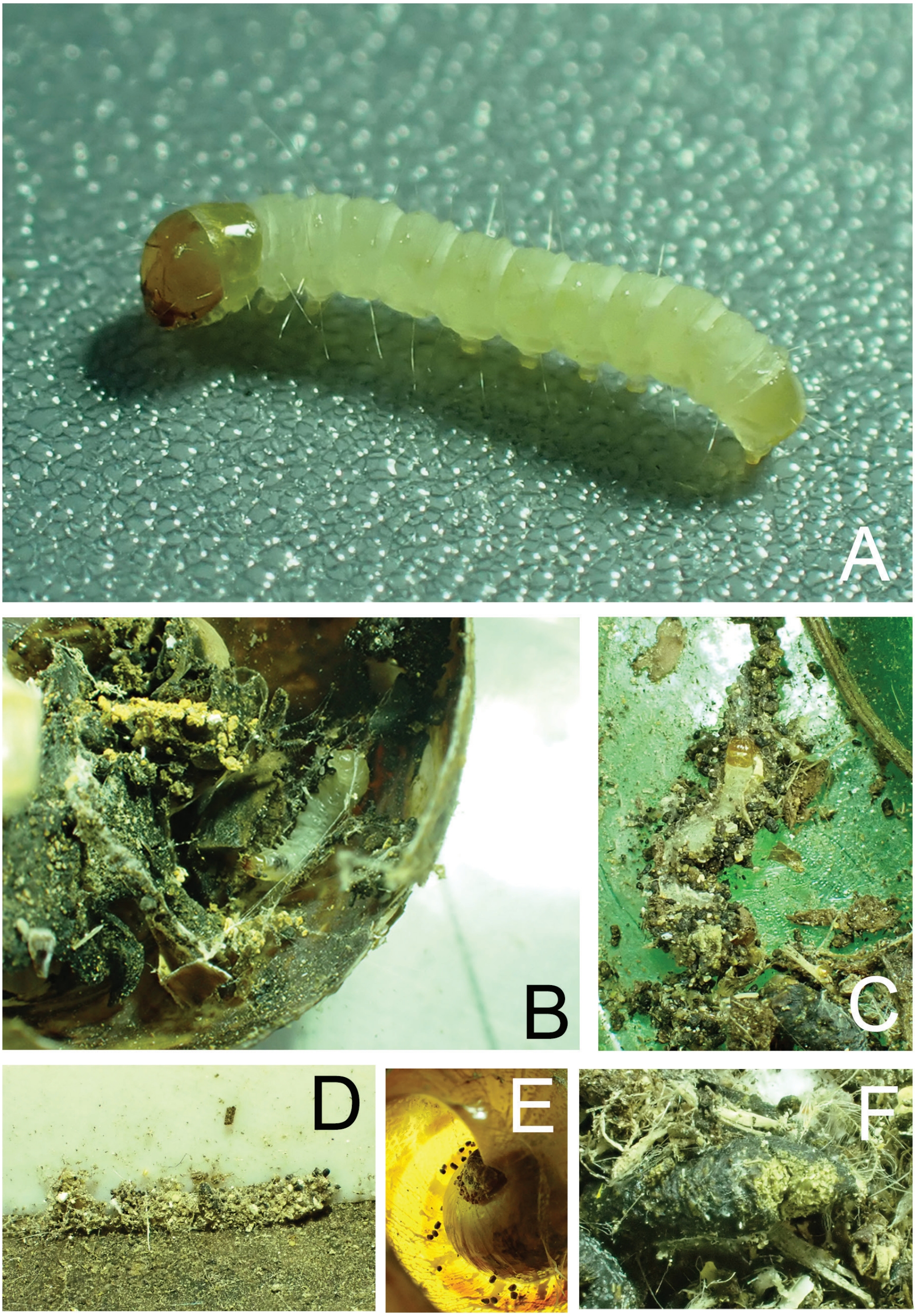

Figure 2. Larvae or feeding traces of *Tenaga nigripunctella.* All photographs Phil Sterling. **A.** Final instar larva; **B.** Larva within the shell of *Cornu aspersum* (NHMUK013700379); **C.** Larva exposed within silken tube at the base of a seed tray; **D.** Silken larval tube on a windowsill of an outhouse; **E.** Larval frass in shell viewed from the shell mouth. **F.** Larval feeding signs on mouse faeces (where surface eaten away).

Several larvae very likely to be of the *Tenaga* were also found in silken tubes and at the base of stacked plant pots and seed trays containing a scattering of detritus including mouse faeces, dead invertebrates, plant and mineral debris, and spider cobwebs (Fig. 2C) and on a windowsill (see Fig. 2D). Despite efforts rear these larvae, attempts have been unsuccessful. From one of the seed trays an intact cocoon was observed from which an adult *Tenaga* emerged. Caution is expressed over concluding that all larvae observed were *Tenaga*, since larvae of *Endrosis sarcitrella* (L.) (Oecophoridae) were also found and reared from within the same locations. Larvae of these two species are superficially very similar, especially prior to final instar, and further work is required to be able to separate these species in the field, although unlike the case for *E. sarcitrella*, the prothoracic plate of *T. nigripunctella* lacks a median suture (Fig. 2A).

The pabula of the larva almost certainly includes the black, dried body tissues of snails, based on the blackish gut content of the two larvae and blackish frass found within the shells. Other pabula inferred from the precise locations of larvae are mouse faeces which appeared to have grazing excavations from the surface (see Fig. 2F), and from a larva found within a dead *Apis mellifera* L. However, there has so far been no direct observation of feeding.

Larvae were observed to be quite active, able to move outside of their silken tubes many tens of centimetres over several minutes, suggesting they can readily move between food sources in the wild. This would fit with observations of frass but no larvae within other snail shells.

The larva spends most of its time within a delicate silken tube adorned with frass and detritus. Prior to pupation the larva constructs a whitish silken cocoon, densely covered with frass and detritus (see Fig. 3A, B). The cocoon is affixed horizontally to a surface or is made within a snail shell.

***Pupa*.** The pupa is over 5 mm long, pale brown, exarate (Fig. 3A, B), with antennal appendages extending just beyond the end of the abdominal shell (Fig. 3C). Dorsal abdominal spines are present (Fig. 3C).

Discussion

Taxonomic placement of *Tenaga*

Here we keep *Tenaga* conservatively in Tineidae, despite the recent works by Gaedike (2019) and Gaedike and Falck (2019). The scavenging lifestyle we suggest here, albeit considering dead snails as a pabulum not containing keratin, is quite out of place for known Meessiidae s.s. (Regier et al. 2015: 17), whilst it is not unusual for some Tineidae (especially Tineinae and Hieroxestinae: Robinson, 2004). The DNA barcode we obtained, using only the neighbour joining algorithm on BOLD, is insufficient to place *T. nigripunctella* with certainty within any tineoid group beyond its clear relationship with *T. rhenania*; this is also the case for most other genera placed by Gaedike in Meessiidae. Indeed, it remains to be confirmed from a molecular perspective which other genera and species belong to Meessiidae beyond *Bathroxena* and *Eudarcia* as sampled by Regier et al. (2015). It would thus be very useful to obtain more sequence data from other genes and analyse the early stages in more detail to confirm the phylogenetic placement of *Tenaga*, whose DNA barcodes yield no apparent clues. There is no doubt that the finding of *T. nigripunctella* and partial elucidation of its life history in Great Britain is of potential taxonomic as well as key biological interest. Descriptions including detailed chaetotaxy (e.g. Sakai and Saigusa 1999) will in future also be useful for confirming family placement, although we thus far noticed no synapomorphic larval characters with Meessidae, such as anal combs for frass flicking, whereas like Tineinae the pupa has dorsal abdominal spines (Regier et al. 2015).

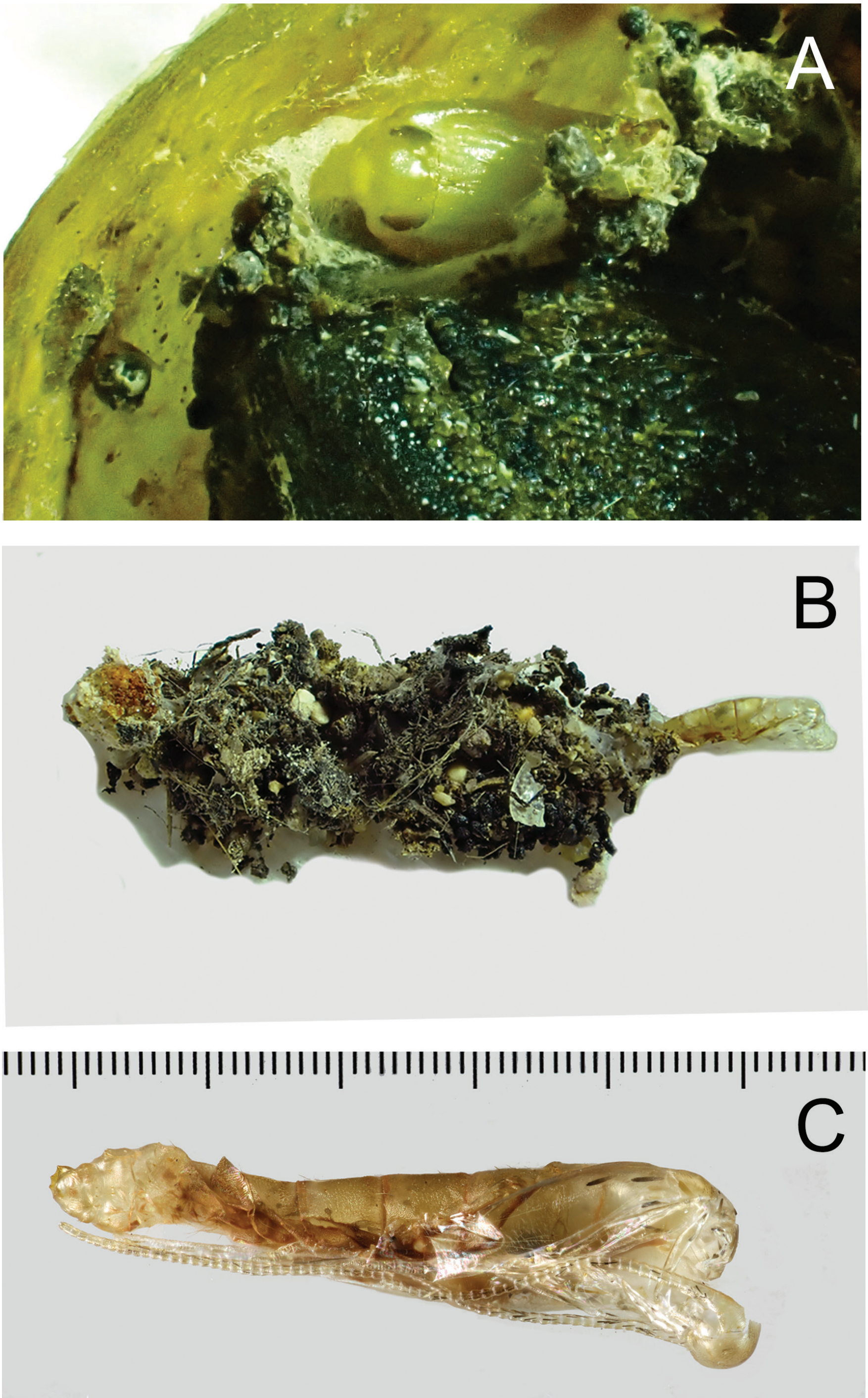

Figure 3. Pupae of *Tenaga nigripunctella*. **A.** Pupa exposed within cocoon in *Cornu* shell, photo Phil Sterling; **B.** Pupal cocoon with exuvium extruded, photo Phil Sterling; **C.** Detail of pupal exuvium showing antennal appendages reaching abdomen tip with scale in mm (NHMUK014171229), photo David Lees.

The fact that there is only a single haplotype shared among four COI-5P sequences (including our own) suggests that this still poorly known species has been introduced more widely, at least to the USA, and probably also to Australia and South Africa (Robinson and Nielsen 1993). It is conceivable that the 1928–1930 records from Kent represented a secondary introduction from the USA, even though the species is not regarded strictly as synanthropic (Robinson and Nielsen 1993).

Molluscs as pabula for Lepidoptera

To our knowledge this is the first observation that infers dead molluscan tissue as a food source for a lepidopteran larva in Great Britain. Snails are unusual resources for micromoths worldwide; the Hawaiian cosmopterigid *Hyposmocoma molluscivora* (Rubinoff 2005) feeds though on live snails (Rubinoff and Haines 2005). However, although also feeding on mouse droppings would be somewhat unusual, the larval behaviour inferred for *Tenaga* lines up with several Tineinae; for example, *Monopis crocicapitella* (Clemens, 1860) is a species sometimes associated with bat guano, whatever nutrients it may be deriving from it (Turbinova et al. 2019). Further work is required to fully document *Tenaga* larval feeding behaviour and to check if it utilises keratin-containing food sources.

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