

## Subspecies of *Pleurota bicostella* (Clerck, 1759) revisited and descriptions of nine new species in the *P. bicostella* species group (Lepidoptera: Gelechioidea: Oecophoridae: Pleurotinae)

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### Abstract

The identities of five subspecies of *Pleurota bicostella* (Clerck, 1759) are studied, and each is raised from subspecies to species: *P. andalusica* Back, 1973, **stat. nov.**; *P. aragonella* Chrétien, 1925, **stat. rev.**; *P. asiatica* Back, 1973, **stat. nov.**; *P. illucidella* Chrétien, 1915, **stat. rev.**; *P. lepigrei* Lucas, 1937, **stat. rev.** Nine new *Pleurota* species which all belong to the *P. bicostella* species group are described: *P. agadirensis* Tabell, **sp. nov.**; *P. aprilella* Tabell, **sp. n.**; *P. karsholti* Tabell, **sp. nov.**; *P. kullbergi* Tabell, **sp. nov.**; *P. monochroma* Tabell, **sp. nov.**; *P. murina* Tabell, **sp. nov.**; *P. paragallicella* Tabell, **sp. nov.**; *P. phaeolepida* Tabell, **sp. nov.**, all from Morocco; and *P. dalilae* Tabell, **sp. nov.** from Tunisia. Adult males and females, and their genitalia are illustrated. DNA barcodes of the aforementioned species are compared with those of all other Pleurotinae available to us in the BOLD database. Each of the presented and barcoded species has a unique BIN (Barcode Index Number).

**Key words:** taxonomy, new status, new species, DNA barcoding, Morocco, Tunisia

### Introduction

This article is the third contribution in a series of revisionary studies on the Palearctic Pleurotinae (Oecophoridae) (Kaila *et al.* 2019; Tabell *et al.* 2019). The aim of this study is to resolve taxonomic issues related to *Pleurota bicostella* (Clerck, 1759), and describe new species belonging to the *P. bicostella* species group. *Pleurota bicostella* is a well-known species, and also the type species of *Pleurota* Hübner, [1825]. According to Back (1973), *P. bicostella* is the most widespread *Pleurota*, its distribution ranging from northern Africa to northern Scandinavia and from Spain to Afghanistan, with several regional subspecies: *P. bicostella bicostella*, distributed in Europe, excluding the southernmost areas, *P. bicostella andalusica* Back, 1973 occurring in southern Spain, *P. bicostella aragonella* Chrétien, 1925 in central Spain, *P. bicostella asiatica* Back, 1973 in Afghanistan and Iran, *P. bicostella illucidella* Chrétien, 1915 in northern Africa from Morocco to Tunisia, and *P. bicostella lepigrei* Lucas, 1937 in Morocco.

Early stages and host plants of Pleurotinae remain largely unknown. *Pleurota bicostella* is a rare exception as its biology is well known; the larva lives on the leaves of *Calluna* and *Erica* (Ericaceae), e.g. in peat bogs, pine forests and heathlands (Tokár *et al.* 2005). Most *Pleurota* species have a one-year development, and the adults fly in spring or summer, often on *Artemisia*-steppes or calcareous slopes.

Collecting excursions to Spain, Tunisia and Morocco in 1984–2016, carried out by O. Karsholt, C. Hviid, K.

Larsen, K. Nupponen, J. Kullberg and J. Tabell, produced several specimens of *Pleurota* phenotypically more or less similar to *P. bicostella*. Examination of the genitalia of the collected material revealed substantial differences in male and female structures, which had remained overlooked previously. These differences correlated with the information obtained from DNA barcodes (see *Molecular data* of *P. bicostella*). We also studied photos of type material of *P. b. asiatica* (genetic information not available). As a result, all five subspecies of *P. bicostella* previously recognised are upgraded to species, and eight species from Morocco and one species from Tunisia are described as new.

## Material and methods

### Collection abbreviations

MNHNP = National Museum of Natural History, Paris, France

MZH = Finnish Museum of Natural History of Helsinki, Finland

NHMUK = Natural History Museum, London, United Kingdom

NHMW = Natural History Museum, Vienna, Austria

ZMUC = Zoological Museum of Copenhagen, Denmark

ZSM = Zoologische Staatssammlung München, Germany

MUT = Research collection of Marko & Tomi Mutanen, Kiiminki, Finland

NUP = Research collection of Timo & Kari Nupponen, Espoo, Finland

SIH = Research collection of Pasi Sihvonen, Kirkkonummi, Finland

TAB = Research collection of Jukka Tabell, Hartola, Finland

The holotype specimens of newly described species are deposited in the public collections of MZH and ZMUC, and the paratype specimens mainly in the private research collections of NUP and TAB. The holotypes that are deposited in MZH have been digitised and have a unique graphical QR code and web identifier, following the open access policy of that museum. URL links for these holotype records are provided in the article. Tissues of at least of two samples of each species, when available, were sent to the Canadian Centre for DNA Barcoding (CCDB) to obtain molecular data of the 658 bp fragment of the mitochondrial COI gene (DNA barcode). Furthermore, 15 public records of *P. bicostella* from different countries, available in the BOLD database ([www.boldsystems.org](http://www.boldsystems.org)), were used. The DNA barcodes of the species presented here were compared with those of all Pleurotinae available to us in BOLD, altogether clustering in 135 different BINs (Barcode Index Numbers). The results are discussed under the *Molecular data* section of each species. The barcodes used in this study are publicly available through the BOLD dataset DS-PLEBIC at [dx.doi.org/10.5883/DS-PLEBIC](https://dx.doi.org/10.5883/DS-PLEBIC). The sequences are also available in GenBank under the accession numbers of MW536097–MW536169.

In addition to the material presented in the current paper, we studied photos of adults and genitalia of several type specimens housed in the National Museum of Natural History, Paris, France, the Natural History Museum, Vienna, Austria, and the Zoologische Staatssammlung München, Germany. In addition, literature was covered extensively.

Terms for forewing markings and male and female genitalia, as well as methods and equipment used for dissecting, photographing and barcoding adult specimens, are presented in Kaila *et al.* (2019) and Tabell *et al.* (2019), and are not repeated here. The vesica of *C. bicostella* was everted via caecum, which was cut open by placing the phallus inside a hypodermic syringe (Sihvonen 2001).

The taxonomy of *Pleurota* is influenced by Back's PhD dissertation (1973). Although it may be difficult to obtain a copy of the dissertation, it constitutes a published work for the purposes of zoological nomenclature and the names published in it are available (ICZN 2000 Articles 8–20).

## Characterization of *P. bicostella* species group

Adults of the *P. bicostella* species group are characterized by grey forewings mixed with white scales and black dots. In most species, a white costal line and a brown subcostal line are also present. Subtriangular valvae are typical in the male genitalia, as well as funnel-shaped gnathos, long posterior lobes of juxta and ear- or crescent-shaped valval

lobes. These features are the most important characters in discriminating among species. In the female genitalia, quadrate segment 8, moderately short apophyses anteriores (slightly longer than segment 8) and medially fused, broad, sclerotized branches of the apophyses anteriores, which form the convex, dorsal proximal margin of segment 8, are characteristic. Also, the shape of signa is a useful distinguishing feature.

The use of DNA barcoding proved helpful and supported species delimitation obtained from the morphological analysis. In the majority of species ( $n = 12$ ), maximum intraspecific divergence is lower than 1 %. In two species it is 1.08 % and 1.24 %, respectively, and in one species 2.66 %. The mean intraspecific divergence is 0.63 %. Interspecific divergence to the nearest neighbour is much higher, the mean being 8.86 %, the minimum 2.79 % and the maximum 13.07 %.

## Taxonomy

The members of the *P. bicostella* species group occurring in the Mediterranean region and further East are listed below, supplemented with their known distribution range. The species are presented in alphabetical order, as the relationships among them are still incompletely known.

- P. agadirensis* Tabell, **sp. nov.** Morocco
- P. aprilella* Tabell, **sp. nov.** Morocco
- P. aragonella* Chrétien, 1925 **stat. rev.** Central Spain
- P. asiatica* Back, 1973 **stat. nov.** Afghanistan, Iran
- P. bicostella* (Clerck, 1759) Western Palearctic
- \* *P. brevispinella* (Zeller, 1847) Italy (Sicily)
- P. creticella* Rebel, 1916 Greece (Crete)
- P. dalilae* Tabell, **sp. nov.** Tunisia
- P. ericella* (Duponchel, 1838) Morocco, Southern France, Spain
- P. falkovitshi* Lvovsky, 1992 Turkey, Turkmenistan, Uzbekistan
- P. hastiformis* Walsingham, 1905 Algeria, Tunisia
- P. illucidella* Chrétien, 1915 **stat. rev.** Tunisia
- P. karsholti* Tabell, **sp. nov.** Morocco
- P. kullbergi* Tabell, **sp. nov.** Morocco
- P. lepigrei* Lucas, 1937 **stat. rev.** Morocco
- P. monochroma* Tabell, **sp. nov.** Morocco
- P. murina* Tabell, **sp. nov.** Morocco
- P. paragallicella* Tabell, **sp. nov.** Morocco
- P. phaeolepida* Tabell, **sp. nov.** Morocco
- P. tristictella* Seebold, 1898 Greece (Samos, Lesbos), Iran, Turkey

\* position in this species group is questionable

## Revision on the subspecies of *P. bicostella* (Clerck, 1759)

### *Pleurota bicostella* (Clerck, 1759)

Barcode Index Number: BOLD:ADD4880

Table 1, Figs. 1–2, 33–34, 51, 65

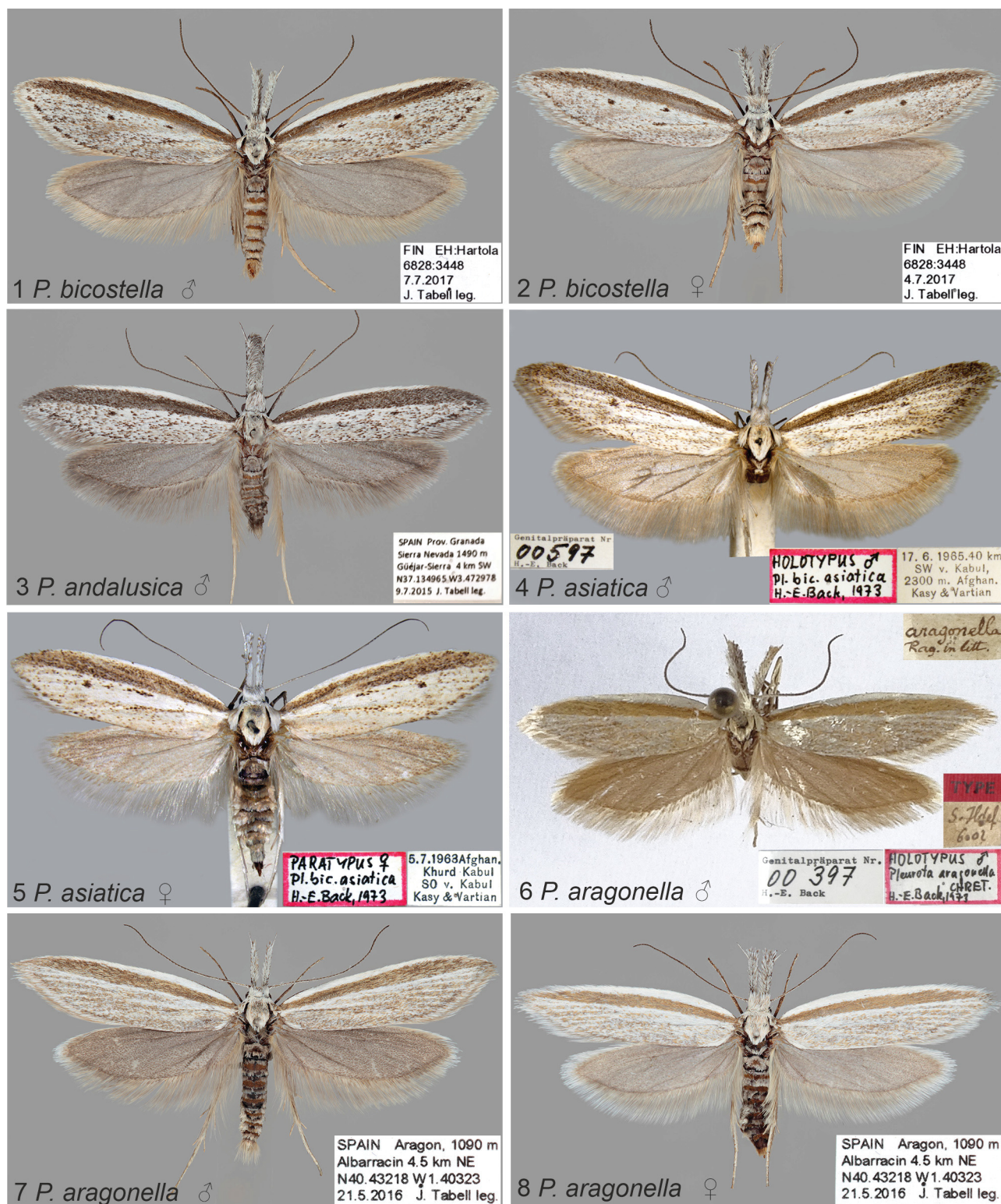
*Phalaena bicostella* Clerck, 1759: pl. 3, fig. 15. Type locality: Scandinavia? Lectotype (NHMUK, not examined) designated by Robinson & Nielsen (1983), who did not indicate the sex.

*Pleurota bicostella* ab. *adscriptella* Krulikowsky, 1908: 18.

**Material studied.** 2 ♂ (DNA sample 00060 Lepid. Phyl; DNA sample 00061 Lepid. Phyl), Finland, Pp: Kiiminki, 29.VI.2006, M. Mutanen leg. (coll. MUT); 34 ♂ (GP 5310 J. Tabell; GP 5881 J. Tabell; DNA sample 23700 Lepid

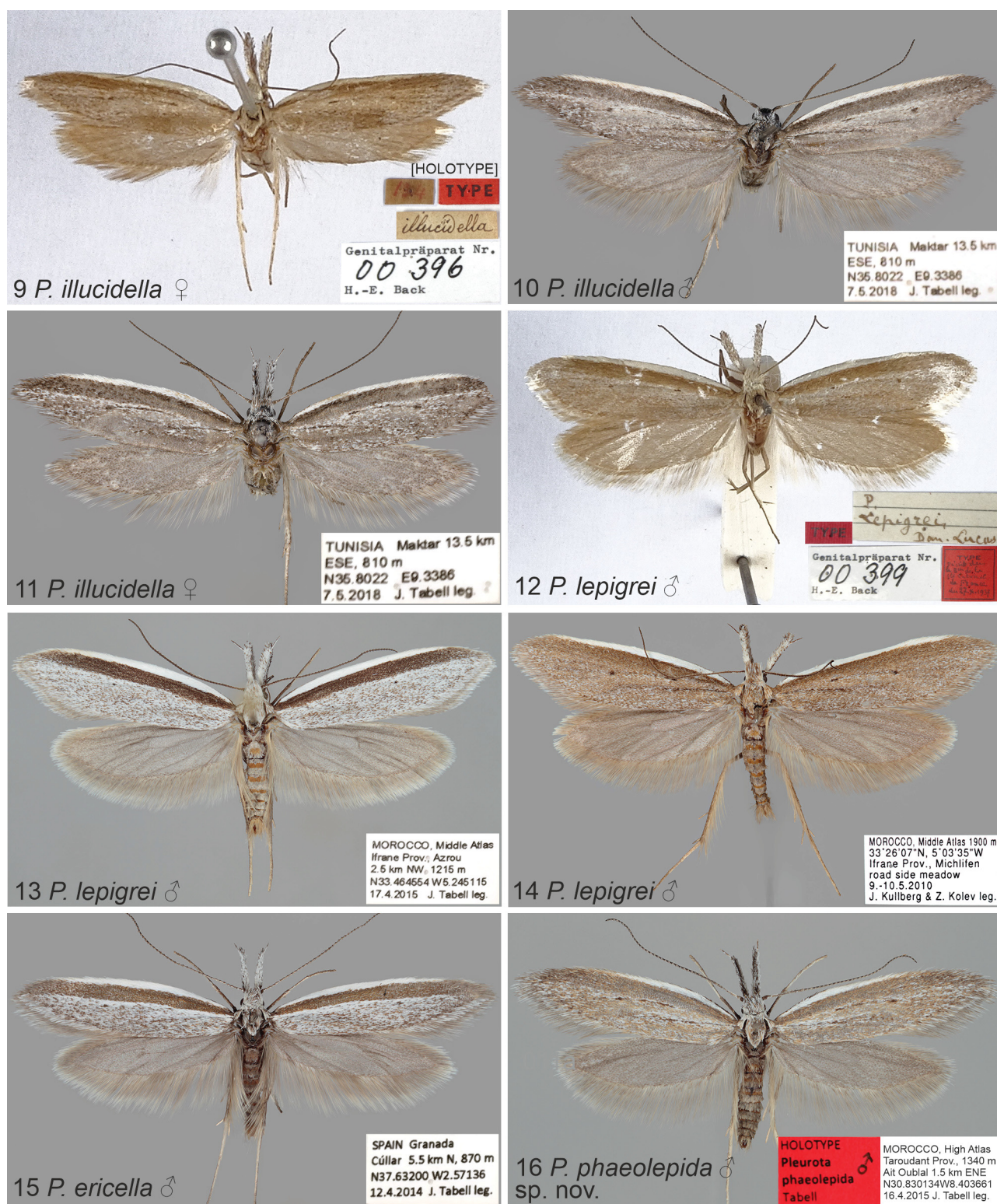


Phyl), 6 ♀ (GP 5477 J. Tabell; GP 5672 J. Tabell; GP 5945 J. Tabell; GP 6026 J. Tabell), Finland, EH: Hartola 682:344, 4.VII.2014–26.VI.2018, J. Tabell leg. (coll. TAB); 1 ♂ (GP 5569 J. Tabell, DNA sample 24663 Lepid Phyl), Russia, Buryatia, 53°13'N 109°19'E, Barguzin valley 1000 m, Ust-Barguzin-Yambui rd. taiga, 13.VII.1996, Jalava & Kullberg (coll. MZH); 1 ♂ (slide Sihvonen 2786), Finland, Kerimäki, Riitasensuo, 2.VII.1997, P. Sihvonen leg. (coll. SIH).



**FIGURES 1–8.** Adults and labels of *Pleurota* spp. 1–2. *P. bicostella* (Clerck). 1. ♂. 2. ♀. 3. *P. andalusica* Back, ♂. 4–5. *P. asiatica* Back. 4. ♂ holotype. 5. ♀ paratype. 6–8. *P. aragonella* Chrétien. 6. ♂ holotype. 7. ♂. 8. ♀.



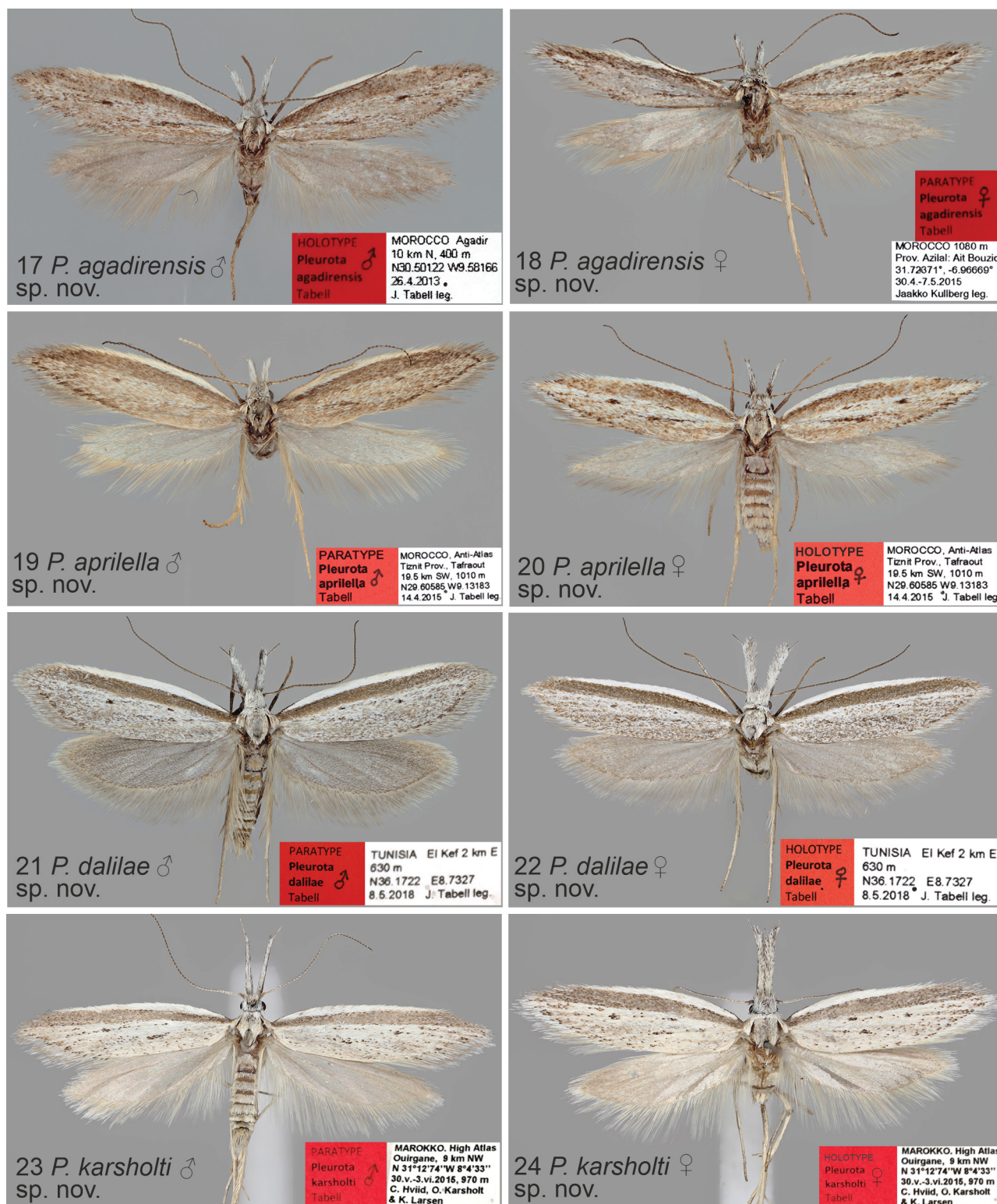


**FIGURES 9–16.** Adults and labels of *Pleurota* spp. 9–11. *P. illucidella* Chrétien. 9. ♀ holotype. 10. ♂. 11. ♀. 12–14. *P. lepigrei* Lucas. 12. ♂ holotype. 13. ♂. 14. ♂. 15. *P. ericella* (Duponchel), ♂. 16. *P. phaeolepida* sp. nov., ♂ holotype.

**Diagnosis.** *Pleurota bicostella* is a relatively large species (wingspan 20–24 mm) compared to most congeners. It is characterized by pale grey forewing mixed with white scales and distinct black discal and discocellular spots. In a rare aberration, *P. bicostella* ab. *adscriptella* Krulikowski, 1908, the forewing is darker, brownish grey without white irroration (Tokár *et al.* 2005). The moderately broad posterior lobe of juxta compared to related species and the crescent-shaped valval lobe in the male genitalia, and small posterior signa in the female genitalia are diagnostic.



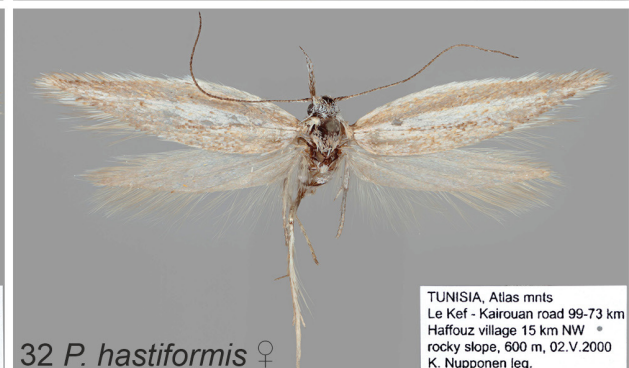
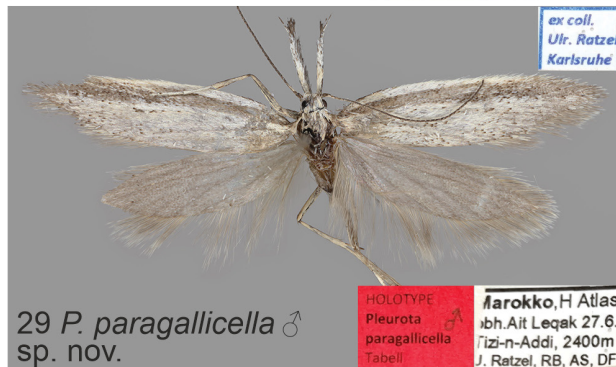
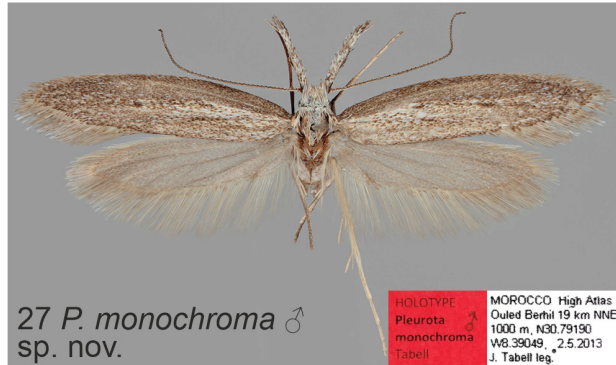
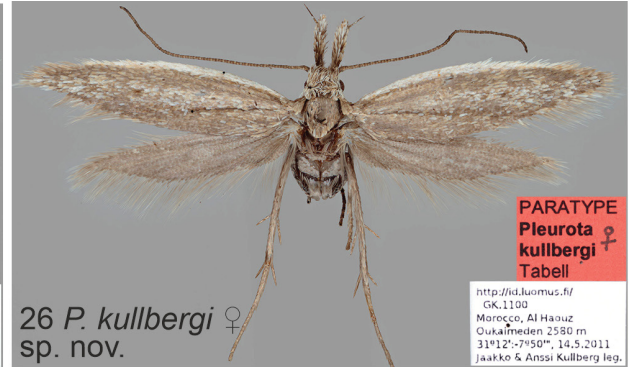
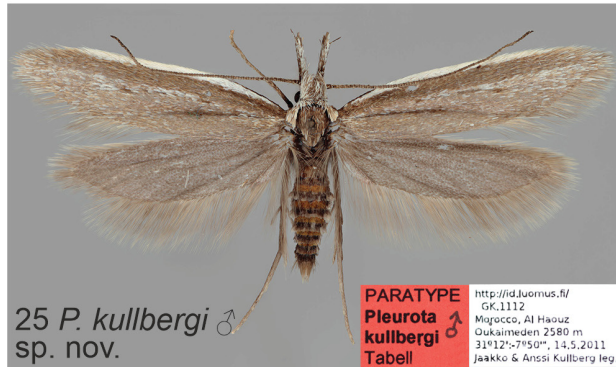
**Molecular data.** Altogether one 657 bp and 22 full-length (658 bp) sequences of *bicostella* were available for genetic analysis. The results revealed 5.56 %–10.06 % divergences between *bicostella* and the other barcoded taxa of the *bicostella* species group (Table 1). The nearest neighbour to *bicostella* is a Moroccan species *P. lepigrei* Lucas, 1937, with a 5.56 % divergence. The barcodes of *bicostella* exhibit 1.08 % intraspecific variation.



**FIGURES 17–24.** Adults and labels of *Pleurota* spp. 17–18. *P. agadirensis* sp. nov. 17. ♂ holotype. 18. ♀ paratype. 19–20. *P. aprilella* sp. nov. 19. ♂ paratype. 20. ♀ holotype. 21–22. *P. dalilae* sp. nov. 21. ♂ paratype. 22. ♀ holotype. 23–24. *P. karsholti* sp. nov. 23. ♂ paratype. 24. ♀ holotype.

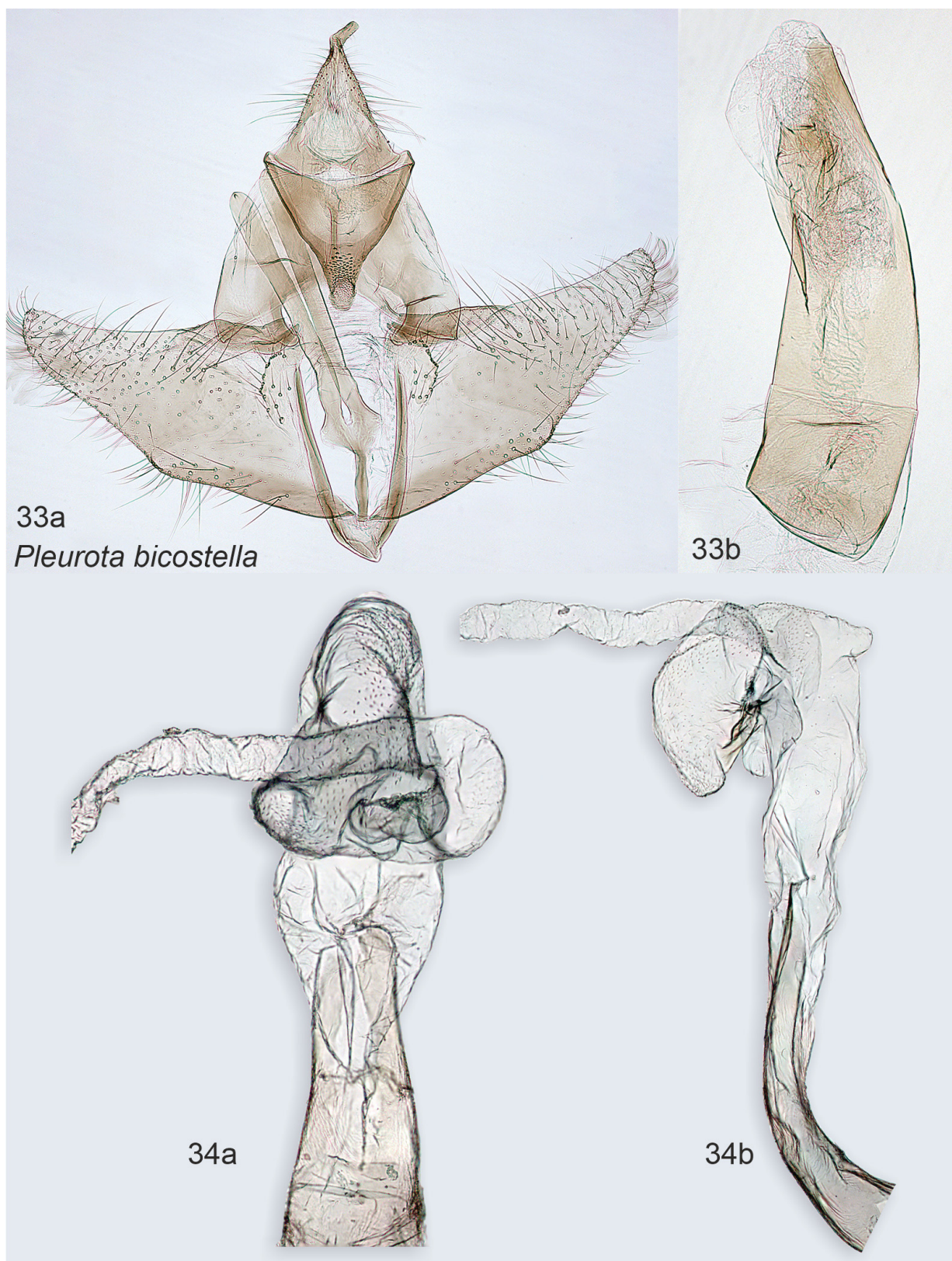


**Description.** Adult. Wingspan 19.6–24.1 mm. Labial palpus off-white, ventrally and laterally brown, 6.5 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.3 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Scape of antenna off-white, flagellum brown. Head, thorax and tegula off-white to pale grey. Forewing pale grey, with scattered brown scales, discal, plical and discocellular spots distinct, blackish brown, fringe line with a few blackish brown flecks; costal line white, moderately broad, from base to 5/6; subcostal line brown, basally slightly narrower. Costal fringe brown, dorsal fringe pale brown, basally white. Hindwing pale brownish grey, margin pale brown, fringe pale brown. Abdomen pale grey, slightly lustrous, each segment with a transverse row of ochre scales.



**FIGURES 25–32.** Adults and labels of *Pleurota* spp. 25–26. *P. kullbergi* sp. nov. 25. ♂ paratype. 26. ♀ paratype. 27. *P. monochroma* sp. nov., ♂ holotype. 28. *P. murina* sp. nov., ♂ holotype. 29. *P. paragalicella* sp. nov., ♂ holotype. 30. *P. gallicella* Huemer & Luquet, ♂. 31–32. *P. hastiformis* Walsingham. 31. ♂. 32. ♀.





**FIGURES 33–34.** Male genitalia of *Pleurota bicostella*. 33a. Genitalia, GP 5310 J. Tabell. 33b. Phallus, caecum intact. 34a. Vesica in dorsal view, caecum removed, slide Sihvonen 2786. 34b. Vesica in lateral view, caecum removed, slide Sihvonen 2786.

Male genitalia. Uncus triangular from ventral view, as long as gnathos, lined with several long and short bristles, apex with parallel-sided stout protuberance. Gnathos subtriangular from ventral view, broad, surface of

apical third covered with scobination. Valva slightly upwardly oblique from ventral view, ventral margin medially slightly bulged, costa almost horizontal; cucullus thimble-shaped; sacculus covered with several bristles; valval lobe well delineated, short, crescent-shaped, covered with several bristles, outer margin lined with small nodules. Juxta tuning-fork-shaped, robust; posterior lobe moderately broad, reaching base of uncus; phallus slightly arched, broad, with one plate-shaped cornutus surrounded by a patch of small spines. Vesica complex, containing small dorsal diverticulum, large ventro-basal diverticulum, ductus ejaculatorius making two distinct curves before opening laterally, large portion of surface covered with microtrichia.

Female genitalia. Papilla analis ovoid, covered with short and long bristles. Apophysis posterioris 2.8 x as long as papilla analis and 1.7 x as long as apophysis anterioris, which is 1.25 x as long as segment 8. Segment 8 quadrate, dorsolaterally reinforced by sclerotized band, distal half covered with several bristles, proximal margin broad, convex, caudal margin concave; ventral longitudinal sclerotization ovoid. Antrum longer than segment 8, moderately broad, partly sclerotized, posterior fourth membranous, anteriorly slightly tapered, with two crescent-shaped opposite patches of different size and two narrow plates with several strongly sclerotized nodules. Ductus bursae moderately broad, membranous. Corpus bursae large, ovoid, with one arched broad signum bearing two narrow, long thorn-like protuberances, and two minute posterior signa.

**Biology.** The larva feeds on the leaves of *Calluna* and *Erica* in a silken web (Tokár *et al.* 2005).

**Distribution.** Widely distributed in the western Palearctic region.

**Remarks:** We illustrate the everted vesica of *bicostella*, possibly for the first time in genus *Pleurota*. The complex structure is indicative that the vesica potentially contains diagnostic characters that may bring additional resolution to the morphology-based taxonomy in the genus.

### ***Pleurota andalusica* Back, 1973 stat. nov.**

Barcode Index Number: BOLD:ACY5987

Table 1, Figs. 3, 35, 52, 65

*Pleurota bicostella andalusica* Back, 1973: 103–105, pls. H (♂ genitalia), Bb 1 (♀ genitalia). Type locality: Spain: Granada, Diezma. Holotype ♂ (ZSM; not found). Here raised from subspecies to species, based on congruent differences in habitus, genitalia structure, and DNA barcodes (**stat. nov.**).

**Material studied.** 4 ♂ (GP 5625 J. Tabell, DNA sample 24568 Lepid Phyl), 7 ♀ (GP 5478 J. Tabell, DNA sample 23569 Lepid Phyl; GP 5775 J. Tabell), Spain, Granada, Sierra Nevada 1490 m, 4 km SW Güejar-Sierra, 2.VII.2015, J. Tabell leg.; 4 ♂, 8 ♀ (GP 5879 J. Tabell; DNA sample 24570 Lepid Phyl; DNA sample 24571 Lepid Phyl), same collecting data, but 9.VII.2015; 2 ♂ (GP 5711 J. Tabell, DNA sample 25599 Lepid Phyl; DNA sample 25600 Lepid Phyl), Spain, Aragon, Huesca, 4.5 km E Castejón de Monegros, 540 m, 5.VII.2016, J. Tabell leg. (all coll. TAB).

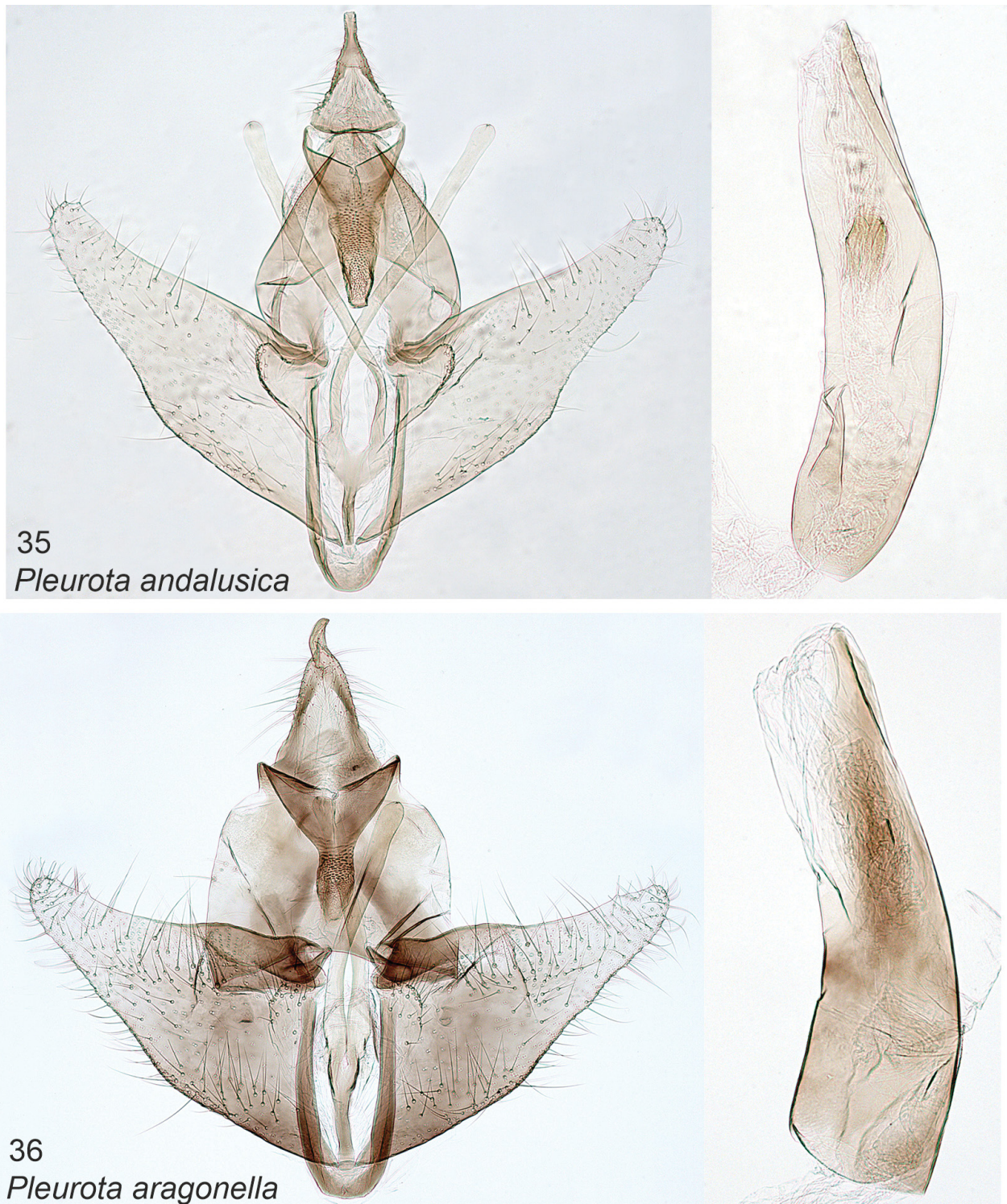
**Diagnosis.** According to Back (1973), the taxon can be distinguished from *P. b. bicostella* by its smaller size, longer labial palp and more contrasted and brightly coloured forewing, in the male genitalia by longer and differently shaped gnathos and longer posterior lobe of juxta, and in the female genitalia by longer ventral longitudinal sclerotization and longer apophysis posterioris. Judging from these characters, combined with the shape of valval lobe in the male genitalia and barcoding information, the systematic position of *andalusica* is not in the *bicostella* group but in the *P. aristella* s.l. species group (see Kaila *et al.* 2019).

**Molecular data.** Six specimens of *andalusica* were sequenced, resulting in 658 bp, full-length barcode sequences for all specimens. The results revealed 7.74 %–10.94 % divergence between *andalusica* and the other barcoded taxa of the *bicostella* species group (Table 1). The nearest neighbour to *andalusica* is a Moroccan species *P. ochreopalpella* Tabell, 2019, which belongs to the *aristella* species group (Kaila *et al.* 2019), with a 4.26 % divergence. The divergence between *andalusica* and *bicostella* is 8.95 % (Table 1). There exists a 1.24 % barcode gap between the populations of Sierra Nevada and Sierra de los Monegros, which may indicate cryptic diversity. The intraspecific variation within these clusters is 0.46 % (n=4) and 0.15 % (n=2), respectively.

**Description.** Adult. Wingspan 13.9–21.2 mm. Labial palpus long, off-white, mixed with brown, ventrally brown, mixed with white, 8 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.3 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Scape off-white, flagellum smooth, brown, slightly serrate. Head and thorax white, tegula mixed with pale brown. Forewing white, dispersed with brown and blackish brown scales, discal spot distinct, blackish brown, hind margin with several blackish brown scales forming a fringe line; costal line white, narrow, from near



base to 0.75; subcostal line brown, broad, basally slightly narrower. Costal fringe brown, dorsal fringe pale brown, apically off-white. Hindwing brownish grey, margin brown, fringe concolorous. Abdomen grey, slightly lustrous, each segment with a transverse row of ochre scales.



**FIGURES 35–36.** Male genitalia of *Pleurota* spp. 35. *P. andalusica* Back, GP 5625 J. Tabell. 36. *P. aragonella* Chrétien, GP 5575 J. Tabell.

Male genitalia. Uncus triangular from ventral view, markedly shorter than gnathos, covered with several long bristles, apex with parallel-sided stout protuberance. Gnathos elongate, funnel-shaped from ventral view, with extensive scobination, evenly tapered towards apex, apex stout. Valva elongate, upwardly oblique, ventral margin medially bulged, costa straight, oblique; cucullus narrow; sacculus broad, covered with several bristles; valval



lobe well delineated, club-shaped, distally covered with several bristles. Juxta tuning-fork-shaped; posterior lobe moderately narrow, long, exceeding the base of uncus. Phallus slightly arched, with one plate-shaped cornutus and two patches of small spines, at apex and around cornutus.

Female genitalia. Papilla analis ovoid, covered with short and long bristles. Apophysis posterioris 4.7 x as long as papilla analis and 1.4 x as long as apophysis anterioris, which is 1.4 x as long as segment 8. Segment 8 longitudinally rectangular, dorsolaterally reinforced by sclerotized band, distally covered with a few short bristles, proximal margin deeply U-shaped; ventral longitudinal sclerotization narrow and long. Antrum as long as segment 8, posterior third membranous, anterior part slightly sclerotized, with two crescent-shaped opposite patches of different size. Ductus bursae short. Corpus bursae ovoid, with one arched robust signum bearing two long moderately broad thorn-like protuberances, and two narrow leaf-shaped posterior signa of different size.

**Biology.** Unknown.

**Distribution.** Spain, Sierra Nevada (Granada) and Sierra de los Monegros (Aragon), locally abundant.

**Note.** Back (1973) stated that the type material was in ZSM, but it has not been found there despite searching efforts (Ulf Buchsbaum and Axel Hausmann, pers. comm.).

### *Pleurota aragonella* Chrétien, 1925 stat. rev.

Barcode Index Number: BOLD:ADI1646

Table 1, Figs. 6–8, 36, 53, 65

*Pleurota aragonella* Chrétien, 1925: 258. Type locality: Spain: Sierra da Guadarrama, San Ildefonso [=La Granja]. Holotype ♂ (MNHN; examined from photographs). Lowered to subspecies by Back (1973). Here elevated from subspecies to species, based on constant differential features in habitus, genitalia structure and DNA barcode (**stat. rev.**).

**Material studied:** 6 ♂ (GP 5692 J. Tabell), 2 ♀ (GP 5878 J. Tabell), Spain, Aragon, 4.5 km NE Albarracin, 20.V.2016, J. Tabell leg.; 13 ♂ (DNA sample 25579 Lepid. Phyl; DNA sample 25608 Lepid. Phyl; DNA sample 25609 Lepid. Phyl), 2 ♀ (GP 5702 J. Tabell, DNA sample 25595 Lepid. Phyl), same collecting data, but 21.V.2016 (all coll. TAB).

**Diagnosis.** Externally *P. aragonella* can be distinguished from *P. bicostella* by its darker forewing with white longitudinal apical stripes and without distinct dark spots. In the male genitalia, the longer uncus, differently shaped gnathos (subtriangular in *bicostella*, funnel-shaped in *aragonella*), broader sacculus and strongly sclerotized phallus are distinguishing characters. In the female genitalia, the long papillae anales, the shape of segment 8 (in *bicostella* quadrate, in *aragonella* obcordate, constricted proximally) and the absence of two posterior signa are distinguishing details.

**Molecular data.** Four specimens of *aragonella* were sequenced, resulting in 658 (n=3) and 622 bp (n=1) barcode sequences. The results revealed distinct, 8.78 %–13.07 % divergence between *aragonella* and the other barcoded taxa of the *bicostella* species group (Table 1). The nearest neighbour to *aragonella* is *P. lepigrei* with an 8.78 % divergence. The divergence between *aragonella* and *bicostella* is 10.06 %. The barcodes of *aragonella* exhibit no intraspecific variation.

**Description.** Adult. Wingspan 21.0–24.0 mm, male larger than female. Labial palpus off-white, mixed with a few pale brown scales, ventrally brown, mixed with white, 7.2 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.28 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Antenna brown, laterally white. Head white, thorax and tegula mixed with white and pale brown. Forewing white, with scattered pale brown and pale grey scales, distinct dark spots absent, median area apically with several short, longitudinal white stripes; costal line white, from near base to apex, tapered towards apex; subcostal line brown, suffused with ochre, expanded towards apex. Fringe white, with pale brown median line. Hindwing grey; fringe paler, with a broad median line. Abdomen grey, slightly lustrous, each segment with a transverse row of ochre scales.

Male genitalia. Uncus bell-shaped from ventral view, elongate, distal half covered with several long bristles, apex with beak-shaped protuberance. Gnathos funnel-shaped from ventral view, as long as uncus, basally broad, medially strongly constricted, apical 0.4 oval and basally surfaced with scobination. Tegumen large, anterior dorsal margin slightly, ventral margin strongly concave. Valva broad, subtriangular, upwardly oblique, ventral margin medially slightly bulged, costa slightly bulged, almost horizontal; cucullus thimble-shaped; sacculus moderately broad and short, covered with several bristles; valval lobe well delineated, crescent-shaped, covered with several

bristles. Anterior extension of juxta robust, median plate narrow; posterior lobe moderately broad, not reaching base of uncus. Phallus slightly arched, broad, well sclerotized, slightly tapered towards apex, with one small plate-shaped cornutus and a few small granules around cornutus.

Female genitalia. Papilla analis elongate, long, densely covered with short bristles. Apophysis posterioris 2.4 x as long as papilla analis and 1.4 x as long as apophysis anterioris, which is 1.2 x as long as segment 8. Segment 8 obcordate or cup-shaped, lateral and proximal margins shallowly more strongly sclerotized, proximal margin strongly convex, caudal margin indistinct, concave, lined with several bristles; ventral longitudinal sclerotization rectangular. Antrum short and moderately broad, sclerotized. Ductus bursae straight, expanded towards corpus bursae. Corpus bursae ovoid, with one medially constricted arched signum bearing two narrow and long protuberances, posterior signa absent.

**Biology.** Unknown.

**Distribution.** Known from Central Spain, Sierra da Guadarrama and Sierra de Albarracín.

**Results.** *P. aragonella* was synonymized with *bicostella* by Back (1973). Both morphology and genetics suggest it is a valid species (**stat. rev.**).

**Note.** According to Back (1973) the female genitalia of *aragonella* are identical to those of *bicostella*. However, the specimens studied by us are markedly distinct from *bicostella*.

### ***Pleurota asiatica* Back, 1973 stat. nov.**

Figs. 4–5, 37, 54

*Pleurota bicostella asiatica* Back, 1973: 105–108, pls. H (♂ genitalia), Bb 2 (♀ genitalia). Type locality: Afghanistan: Kabul.

Holotype ♂ (NHMW; examined from photographs). Here elevated from subspecies to species, based on constant differential features in habitus and genitalia structure (**stat. nov.**).

**Material examined.** Holotype ♂ (Genitalpräparat Nr. 00597 H.-E. Back), 17.VI.1965 Afghan., 40 km SW v. Kabul, 2300 m., Kasy & Vartian. Paratypes: 1 ♀, 5.VII.1963 Afghan., Khurd Kabul, SO v. Kabul, Kasy & Vartian; 1 ♀ (Genitalpräparat Nr. 00605 H.-E. Back), 7.VII.1963 Afghan., 35 km O v. Kabul, Kasy & Vartian [examined from photographs]. The holotype is deposited in NHMW. The male and female genitalia are illustrated and described by Back (1973).

**Diagnosis.** Externally *P. asiatica* can be distinguished from *P. bicostella* by its browner colour (greyer in *bicostella*) and broader subcostal line. In the male genitalia, distinguishing details are the funnel-shaped gnathos (subtriangular in *bicostella*), longer and narrower posterior lobe of juxta, differently shaped lateral lobe of juxta (finger-shaped in *asiatica*, crescent-shaped in *bicostella*), and broader cucullus. In the female genitalia, the anterior and posterior apophyses are longer and the posterior signa bigger than in *bicostella* and the U-shaped proximal margin of segment 8 is distinctive.

**Molecular data.** No specimens have been barcoded.

**Description.** Adult. Wingspan 18.0–21.0 mm. Labial palpus off-white, mixed with pale brown, ventrally brown, mixed with white, 3<sup>rd</sup> palpomere 0.3–0.45 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Head and tegula off-white, thorax pale brown, in female whiter. Forewing white, dispersed with brown scales, more densely at apical half, discal spot and a streak between discal and discocellular spot distinct, blackish brown, plical streak indistinct; costal line white, from near base to 0.57–0.67; subcostal line brown, evenly expanded towards apex; hind margin with several brown scales forming a fringe line. Costal fringe brown, dorsal fringe brown with paler medial line. Hindwing pale brown, fringe pale brown, apically whiter, in female hindwing and fringe greyer.

Male genitalia. Uncus triangular from ventral view, shorter than gnathos, covered with several long and short bristles, apex with stout protuberance. Gnathos funnel-shaped from ventral view, basally broad, apical half narrow, parallel-sided, covered with dense scobination, apex stout. Valva slightly upwardly oblique, ventral margin medially slightly bulged, costa concave; cucullus thimble-shaped; valval lobe finger-shaped, distally covered with several bristles. Anterior extension of juxta short; median plate robust; posterior lobe narrow, extended to uncus. Phallus slightly arched, broad, with a sclerotized plate-shaped cornutus surrounded by numerous tiny spines.

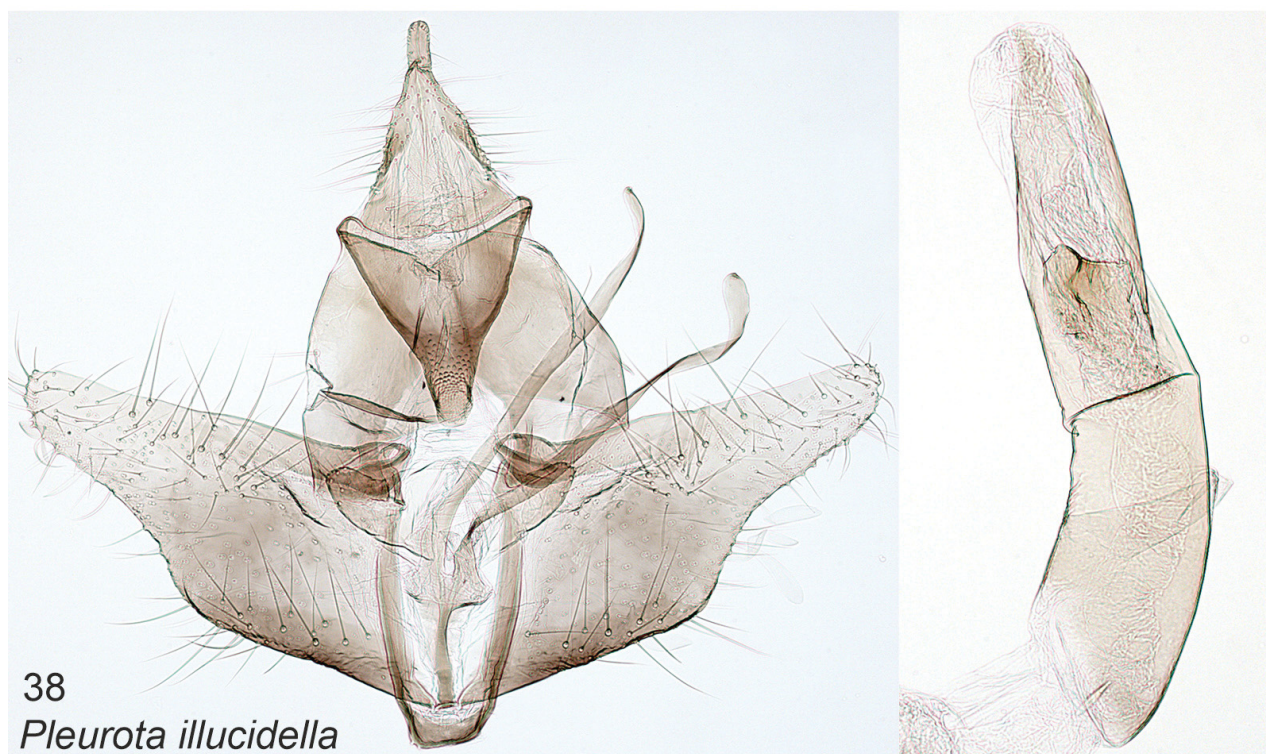
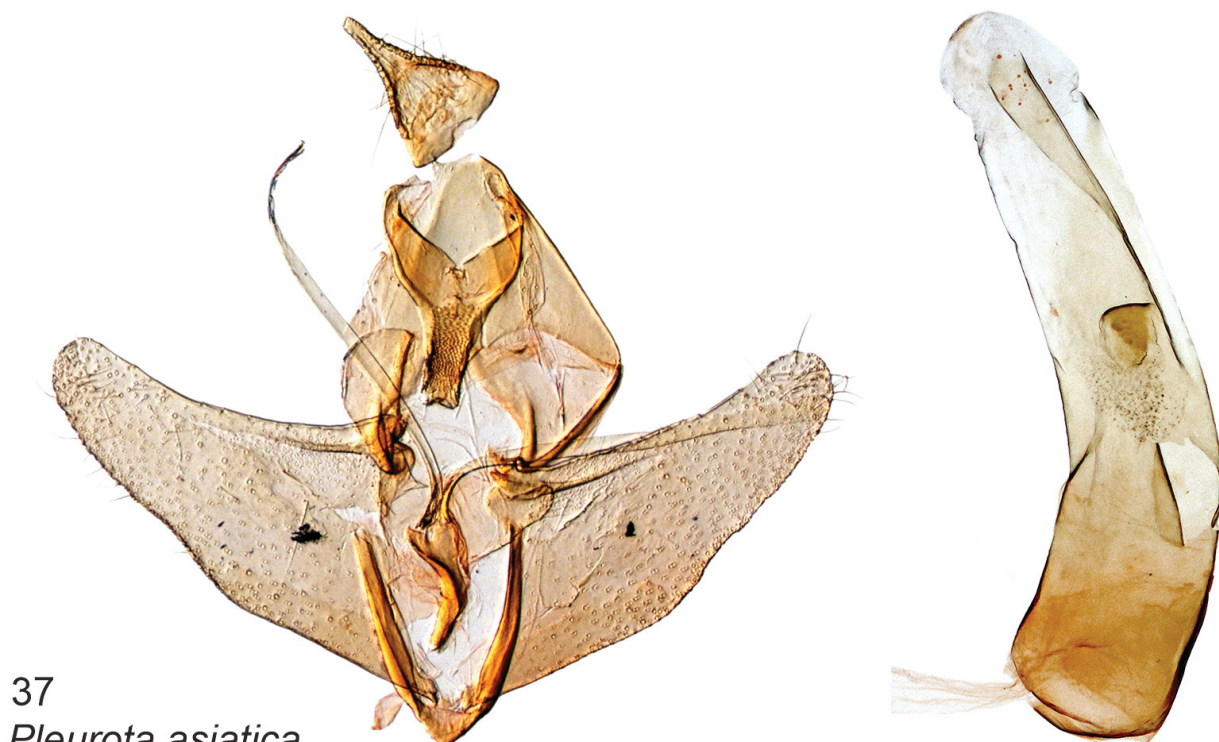
Female genitalia. Papilla analis narrow, elongate. Apophysis posterioris 4.2 x as long as papilla analis and 1.5 x as long as apophysis anterioris, which is 1.5 x as long as segment 8. Segment 8 longitudinally rectangular, dorsolaterally reinforced by sclerotized band, proximal margin strongly sclerotized, broad, deeply convex, caudal



margin slightly concave. Antrum as long as segment 8, narrow. Ductus bursae membranous, shorter than antrum. Corpus bursae ovoid, with one large, arched, broad, medially constricted signum bearing two strongly sclerotized thorn-like protuberances, and two leaf-shaped posterior signa of different size.

**Biology.** Unknown.

**Distribution.** Afghanistan, Iran.



**FIGURES 37–38.** Male genitalia of *Pleurota* spp. 37. *P. asiatica* Back, holotype, Genitalpräparat Nr. 00597 H.-E. Back. 38. *P. illucidella* Chrétien, GP 6021 J. Tabell.



***Pleurota illucidella* Chrétien, 1915 stat. rev.**

Barcode Index Number: BOLD:ADR8160

Table 1, Figs. 9–11, 38, 55, 65, 66

*Pleurota illucidella* Chrétien, 1915: 336. Type locality: Tunisia: Gafsa. Holotype ♀ (MNHN; examined from photographs). Originally described as a species, lowered to subspecies by Back (1973). Here elevated again to species level based on differential features in habitus, genitalia structure and DNA barcode (**stat. rev.**)

**Material examined.** 1 ♀ (GP 5766 J. Tabell, DNA sample 24833 Lepid Phyl [barcoding failed]), Tunisia, Atlas mnts, 15 km NE Makhtar village, conifer forest, 1000 m, 3.V.2000, K. Nupponen leg. (coll. NUP); 1 ♂ (GP 6021 J. Tabell, DNA sample 26140 Lepid Phyl), 1 ♀ (GP 5917 J. Tabell, DNA sample 26141 Lepid Phyl), Tunisia, 13.5 km ESE Maktar, 810 m, N35.8022 E9.3386, 7.V.2018, J. Tabell leg. (coll. TAB).

The genitalia are illustrated and described by Back (1973), but the drawing of male genitalia belongs to some other species, probably to *P. lepigrei*. Only the corpus bursae with signa is illustrated for the female genitalia, but the characteristic crescent-shaped anterior signum together with the coloration of the adult, enables a plausible identification.

**Diagnosis.** Externally *P. illucidella* is somewhat similar to *P. dalilae*, but the forewing is slightly darker, due to irroration of blackish brown scales. The strongly concave ventral margin of valva, and finger-shaped valval lobe in the male genitalia are distinguishing details. In the female genitalia, the shape of the proximal margin of segment 8 and anterior signum are distinctive.

**Molecular data.** Two specimens of *illucidella* were sequenced successfully, resulting in 658 and 637 bp barcode sequences. The sequences are 6.29 %–10.55 % divergent from the other barcoded taxa of the *bicostella* species group (Table 1). The nearest neighbour to *illucidella* is *P. kullbergi* with a 6.29 % divergence. The divergence between *illucidella* and *bicostella* is 8.68 %. The barcodes of *illucidella* exhibit no intraspecific variation.

**Description.** Adult. Wingspan 16.6–18.0 mm. Labial palpus off-white, ventrally brown, mixed with white, 6.9 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.27 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Antenna brown. Head, thorax and tegula off-white, mixed with pale brown. Forewing off-white, mixed with pale ochre, pale grey and pale brown scales, small but distinct discal and discocellular spots formed of dark brown scales, plical streak distinct, in outer 0.5 indistinct brown longitudinal streaks, fringe line distinct; costal line white, from near base to 0.8; subcostal line brown, slightly expanded towards apex. Fringe off-white, with subapical pale grey line. Hindwing pale grey, fringe pale grey, apically white. Abdomen pale grey, slightly lustrous, each segment with a transverse row of ochre scales.

Male genitalia. Uncus triangular from ventral view, slightly longer than gnathos, covered with several long and short bristles, apex with finger-shaped protuberance. Gnathos funnel-shaped from ventral view, evenly tapered towards apex, apical half surfaced with scobination, apex rounded. Valva slightly upwardly oblique, ventral margin medially bulged; cucullus moderately narrow; valval lobe finger-shaped, distal margin lined with a few nodules with short bristles. Anterior extension of juxta straight, median plate broad; posterior lobe exceeding the base of uncus. Phallus slightly arched, parallel-sided, with one plate-shaped cornutus and a few indistinct small nodules.

Female genitalia. Papilla analis elongate, covered with short and long bristles. Apophysis posterioris 3.5 x as long as papilla analis and 1.9 x as long as apophysis anterioris, apophysis anterioris 1.35 x as long as segment 8. Segment 8 quadrate, lateral margin sclerotized by a narrow band, proximal margin convex, strongly sclerotized, medially broader, caudal margin indistinct, concave, lined with several bristles; ventral longitudinal sclerotization broad, ovoid. Antrum slightly shorter than segment 8, anteriorly tapered and more sclerotized. Ductus bursae membranous, as broad as antrum. Corpus bursae ovoid, very large, with one crescent-shaped signum bearing two narrow and long protuberances, and two smaller leaf-shaped posterior signa of different size.

**Biology.** Unknown. The specimens collected by the first author were netted from *Salvia rosmarinus* Spenn (Lamiaceae) in a pine forest.

**Distribution.** Tunisia.

**Results.** *P. illucidella* was synonymized with *bicostella* by Back (1973). Both morphology and genetics suggest it is a valid species (**stat. rev.**).

***Pleurota lepigrei* Lucas, 1937 stat. rev.**

Barcode Index Number: BOLD:ACW2140, ADB1232

Table 1, Figs. 12–14, 39, 56, 65, 66

*Pleurota lepigrei* Lucas, 1937: 233. Type locality: Morocco: Barcha. Holotype ♂ (MNHNP; examined from photographs). Originally described as a species, lowered to subspecies by Back (1973). Here restored to species rank based on distinctness in habitus, genitalia structure and DNA barcode (**stat. rev.**).

**Material studied.** 1 ♂ (GP 5512 J. Tabell, DNA sample 24634 Lepid Phyl), 1 ♀ (GP 5540 J. Tabell), Morocco, 25 km S Essaouira, Sidi Kaouki, 100 m, 28.III.2005, O. Karsholt.; 2 ♂ (GP 5312 J. Tabell, DNA sample 23673 Lepid Phyl; DNA sample 23672 Lepid Phyl), 1 ♀ (GP 5414 J. Tabell, DNA sample 24592 Lepid Phyl), Morocco, 2 km SE Ourika, 930 m, N31.355 W7.769, 2.V.2013, J. Tabell leg.; 1 ♂ (GP 5309 J. Tabell, DNA sample 23671 Lepid Phyl), Morocco, 2 km NW Azrou, 1220 m, N33.474 W5.247, 6.V.2013, J. Tabell leg.; 2 ♀ (DNA sample 24521 Lepid Phyl), Morocco, Al Haouz Prov., High Atlas, 3 km SE Ourika, 960 m, N31.353 W7.767, 16.IV.2015, J. Tabell leg.; 13 ♂ (GP 5443 J. Tabell, DNA sample 23732 Lepid Phyl; DNA sample 24523 Lepid Phyl), 1 ♀ (GP 5444 J. Tabell, DNA sample 24520 Lepid Phyl), Morocco, Ifrane Prov., Middle Atlas, 2.5 km NW Azrou, 1215 m, N33.465 W5.245, 17.IV.2015, J. Tabell leg.; 1 ♂, 1 ♀, Morocco, Ifrane Prov., 3 km NNW Azrou, 1210 m, N33.464 W5.245, 14.V.2016, J. Tabell leg.; 6 ♂, same collecting data, but 16.V.2016 (all coll. TAB).

The female has been unknown until now.

**Diagnosis.** Externally *P. lepigrei* can be distinguished from *P. bicostella* by the reduced dark spots on forewing. In the male genitalia, distinguishing details from *bicostella* are the funnel-shaped gnathos, ear-shaped valval lobe (in *bicostella*, gnathos subtriangular and valval lobe crescent-shaped), longer posterior lobe and narrower cucullus. In the female genitalia, the sclerotized proximal margin of segment 8 is broadly V-shaped (slightly concave in *bicostella*) and posterior signa are markedly bigger.

**Molecular data.** Altogether ten specimens of *lepigrei* were sequenced, resulting in 658 bp, full-length barcode sequences for nine specimens, and a fragment of 631 bp for one specimen. The results revealed 2.99 %–9.58 % divergence between *lepigrei* and the other barcoded taxa of the *bicostella* species group (Table 1). The nearest neighbour to *lepigrei* is the Tunisian *P. dalilae*, with a 2.99 % divergence. The divergence between *lepigrei* and *bicostella* is 5.56 %. The barcodes of *lepigrei* exhibit 2.66 % maximum intraspecific divergence with two different BINs, which may indicate cryptic diversity.

**Description.** Adult. Wingspan 19.8–23.7 mm. Labial palpus white, sparsely mixed with pale brown, ventrally brown, mixed with white, 5.9 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.3 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Scape dorsally brown, ventrally white, flagellum slightly serrate, brown. Head, thorax and tegula off-white. Forewing pale grey, evenly dispersed with brown scales, discal spot distinct but small, blackish brown; costal line white, from base to 0.83; subcostal line brown, almost parallel-sided. Fringe pale brown, basally white. Hindwing pale grey, margin pale brown, fringe pale brownish grey, apically white.

Male genitalia. Uncus triangular from ventral view, elongate, as long as gnathos, covered with several long and short bristles, apex with stout protuberance. Gnathos funnel-shaped from ventral view, basally broad, apical third narrow, almost parallel-sided, smooth, apex rounded. Tegumen large, both anterior margins concave. Valva subconical, ventral margin evenly curved, costa slightly upwardly oblique; sacculus moderately broad and short, covered with several bristles; valval lobe well delineated, ear-shaped, covered with several bristles. Median plate of juxta strongly swollen; posterior lobe moderately narrow, extended to uncus. Phallus slightly arched, broad, well sclerotized, with a plate-shaped cornutus.

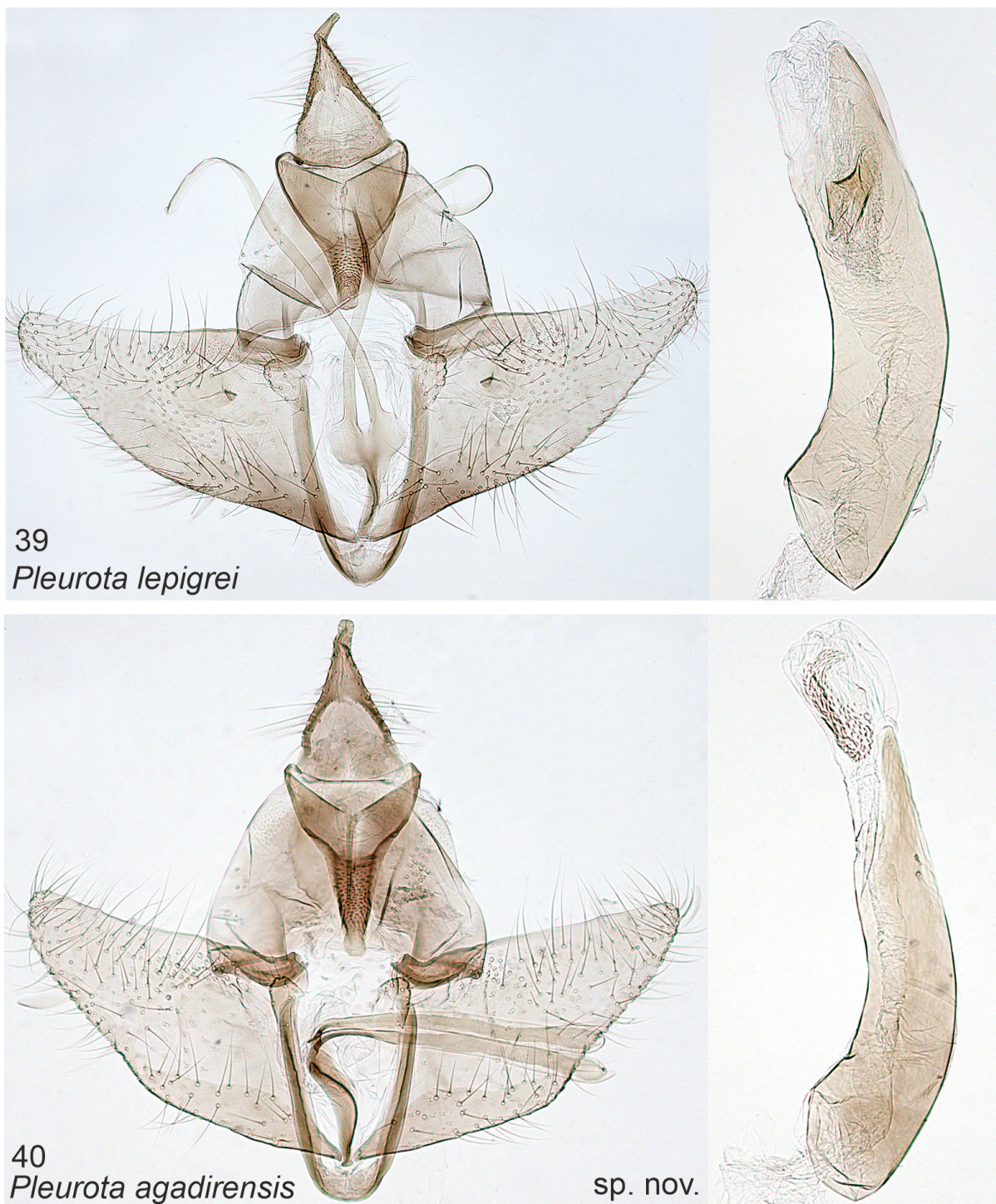
Female genitalia. Papilla analis narrow, elongate, covered with bristles. Apophysis posterioris 2.9 x as long as papilla analis and 1.5 x as long as apophysis anterioris, which is 1.5 x as long as segment 8. Segment 8 longitudinally rectangular, dorsolaterally reinforced by sclerotized band, proximal margin strongly sclerotized, broad, V-shaped, caudal margin slightly concave, edged with several bristles; ventral longitudinal sclerotization club-shaped. Antrum slightly longer than segment 8, parallel-sided, posteriorly slightly sclerotized with two more sclerotized patches. Ductus bursae membranous, as broad as antrum. Corpus bursae ovoid, with one large arched, medially slightly constricted signum bearing two narrow long protuberances, and two leaf-shaped posterior signa of different size.

**Biology.** Unknown.

**Distribution.** Morocco, the High Atlas and Middle-Atlas Mountains, locally abundant.

**Note.** Synonymized with *bicostella* by Back (1973). Both morphology and genetics suggest it is a valid species (**stat. rev.**).





**FIGURES 39–40.** Male genitalia of *Pleurota* spp. 39. *P. lepigrei* Lucas, GP 5443 J. Tabell. 40. *P. agadirensis* **sp. nov.**, holotype, GP 5314 J. Tabell.

#### Descriptions of new species of the *P. bicostella* species group

##### *Pleurota agadirensis* Tabell, sp. nov.

Barcode Index Number: BOLD:ACW1991

Table 1, Figs. 17–18, 40, 57, 65, 66

**Type material.** Holotype ♂ (GP 5314 J. Tabell, DNA sample 23691 Lepid. Phyl.): Morocco, Agadir 10 km N,



400 m, N30.501 W9.582, 26.IV.2013, J. Tabell leg. (coll. MZH), BOLD sample ID: MM23619, <http://id.luomus.fi/GBT.2> Paratype: 1 ♀ (GP 5761 J. Tabell, DNA sample 25775 Lepid Phyl), Morocco 1080 m, Prov. Azilal, Ait Bouzid, 31.72371°, -6.96669°, 30.IV.–7.V.2015, Jaakko Kullberg leg. (coll. MZH).

**Diagnosis.** Externally *P. agadirensis* is similar to *P. aprilella* and *P. phaeolepida*, and positive identification requires examination of genitalia structures. In male genitalia, the shape of valva and cucullus, and the boot-shaped arrangement of cornuti distinguish *agadirensis* from the other species. Female genitalia are similar to those of *aprilella*, but the proximal margin of segment 8 is less convex, and the antrum is longer.

**Molecular diagnosis.** Both type specimens of *agadirensis* were sequenced, resulting in 658 bp and 627 bp barcode sequences. The nearest neighbour to *agadirensis* is *aprilella*, with a 2.79 % divergence (Table 1). The barcodes of *agadirensis* exhibit 0.64 % intraspecific variation.

**Description.** Adult. Wingspan male 12.9 mm, female 11.1 mm. Labial palpus 5.3 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.28 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres, dirty white mixed with few pale brown scales, ventrally brown. Antenna brown, scape brown, ventrally white. Head, thorax and tegula dirty white, mixed with pale brown. Forewing covered with fuscous, brown, white and grey scales, blackish brown discal spot distinct, elongated, plical streak distinct, fringe line formed of several brown scales; costal line off-white, narrow, from near base to 0.67; subcostal line moderately broad, brown, mixed with darker scales, widened from base to apex. Fringe off-white, mixed pale brown. Hindwing and fringe pale brown.

Male genitalia. Uncus triangular from ventral view, slightly shorter than gnathos, lined with several long and short bristles, apex with short stout protuberance. Gnathos funnel-shaped from ventral view, broad, smooth, distal half elongate, evenly tapered towards stout apex. Valva conical, costa straight, slightly oblique. Sacculus moderately broad. Valval lobe small, outer margin rounded; posterior lobe reaching the base of uncus. Phallus slightly arched, well sclerotized, tapered towards apex, with a boot-shaped formation of tiny spines.

Female genitalia. Papilla analis oval, covered with long bristles. Apophysis posterioris about 3 x as long as papilla analis and 1.6 x as long as apophysis anterioris, which is 1.3 x as long as segment 8. Segment 8 longitudinally rectangular, weakly sclerotized, distal half sparsely covered with short bristles, dorsolaterally reinforced by sclerotized band; proximal margin strongly sclerotized, broadly U-shaped, medially broader; ventral longitudinal sclerotization oval. Antrum tubular, as long as segment 8, densely surfaced by small nodules, anterior section with two crescent-shaped opposite patches. Ductus bursae narrower than antrum. Corpus bursae spherical, with one broad crescent-shaped signum bearing two strongly sclerotized thorn-like protuberances and two narrow posterior signa of equal size.

**Biology.** The biology is unknown. The type material was collected at light.

**Etymology.** The specific epithet refers to Agadir, Morocco, the type locality.

**Distribution.** Known only from two localities in the High Atlas Mountains at an altitude of 400 m and 1080 m.

### *Pleurota aprilella* Tabell, sp. nov.

Barcode Index Number: BOLD:ACW2251

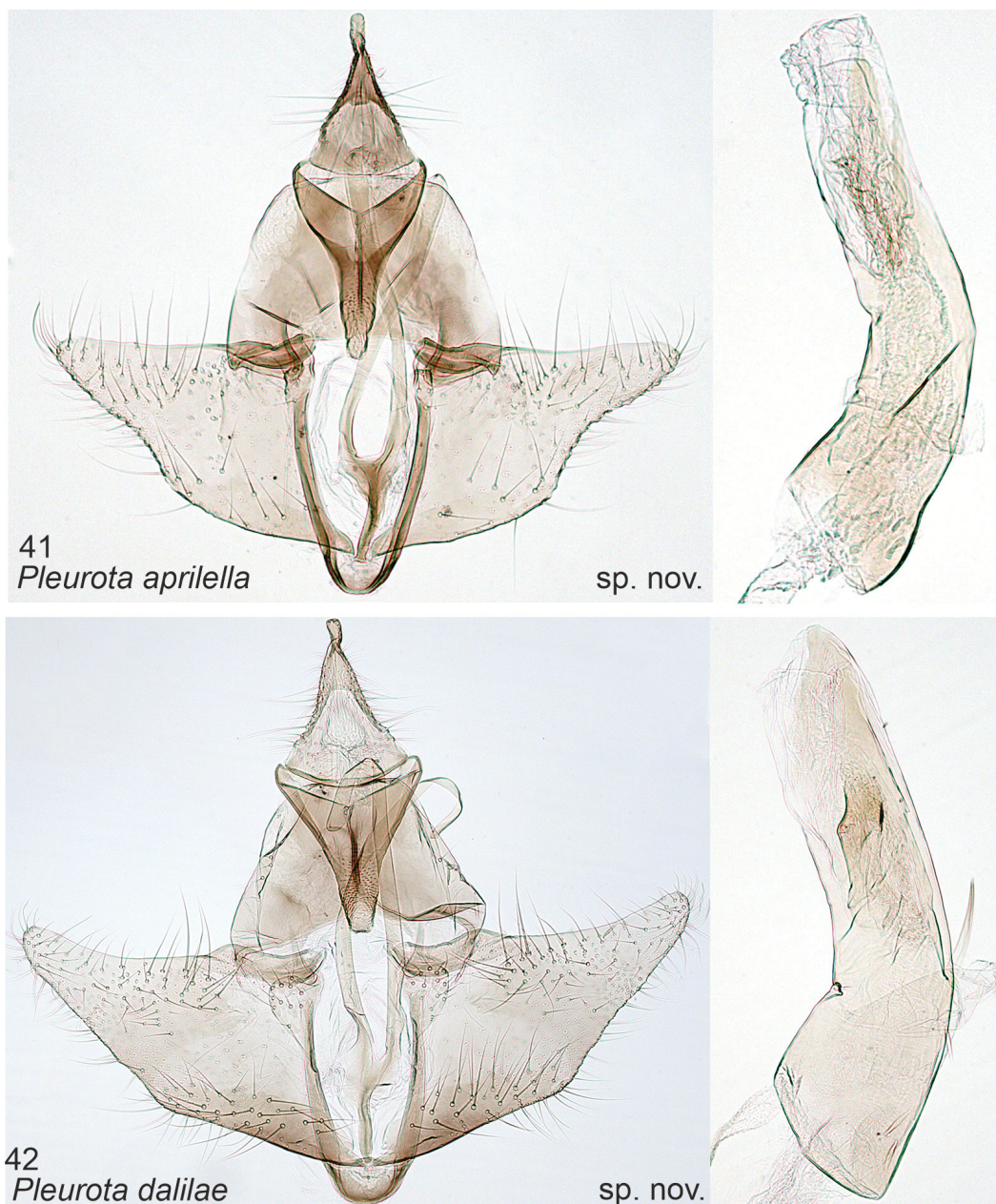
Table 1, Figs. 19–20, 41, 58, 65, 66

**Type material.** Holotype ♀ (DNA sample 23740 Lepid. Phyl.): Morocco, Tiznit Prov., Anti-Atlas, Taфраout 19.5 km SW, 1010 m, N29.606 W9.132, 14.IV.2015, J. Tabell leg. (coll. MZH), BOLD sample ID: MM23740, <http://id.luomus.fi/GBT.3> Paratypes: 2 ♂ (GP 5442 J. Tabell, DNA sample 23739 Lepid. Phyl.; DNA sample 23750 Lepid. Phyl.), 2 ♀ (GP 5499 J. Tabell, DNA sample 23741 Lepid. Phyl.) same collecting data as holotype (all in coll. TAB).

**Diagnosis.** Externally *P. aprilella* is similar to *P. agadirensis* and *P. phaeolepida*, and reliable identification requires examination of genitalia structures. In male genitalia, the narrow apical half of gnathos, straight costa, angular valval lobe and concave ventral margin of valva are distinguishing characters. The female genitalia are similar to those of *agadirensis*, but the proximal margin of segment 8 is more convex in *aprilella*, and the antrum is shorter.

**Molecular data.** Three specimens of *aprilella* were sequenced successfully, resulting in 658 bp, full-length barcode sequences. The nearest neighbour to *aprilella* is *agadirensis* with a 2.79 % divergence (Table 1). The barcodes of *aprilella* exhibit 0.15 % intraspecific variation.

**Description.** Adult. Wingspan 11.5–12.1 mm. Labial palpus 4.6 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.24 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres, mixed with brown and white scales, below brown, basally mixed with white. Antenna pale brown, below dark brown, scape pale brown, below off-white. Head, thorax and tegula dirty white, mixed with pale brown. Forewing covered with fuscous and off-white scales, dark brown discal and discocellular spots small, plical streak weak, fringe line distinct; costal line white, narrow, from near base to 3/4; subcostal line moderately broad, brown. Fringe pale brown, basally off-white. Hindwing pale grey, fringe pale fuscous. In female discal and discocellular spots and plical streak more distinct, and medial area of forewing whiter.



**FIGURES 41–42.** Male genitalia of *Pleurota* spp. 41. *P. aprilella* **sp. nov.**, paratype, GP 5442 J. Tabell. 42. *P. dalilae* **sp. nov.**, paratype, GP 5920 J. Tabell.

Male genitalia. Uncus triangular from ventral view, shorter than gnathos, lined with few long bristles, apex with long, narrow and stout protuberance. Gnathos funnel-shaped from ventral view, distal half elongate, narrow, covered with scobination, evenly tapered towards stout apex. Tegumen large, dorsal margin slightly concave. Ventral margin of valva concave, costa straight, horizontal. Sacculus weakly sclerotized. Juxta tuning-fork-shaped; valval lobe small, angular, covered with few bristles; posterior lobe reaching the base of uncus. Phallus arched, with a patch of numerous tiny spines.



Female genitalia. Papilla analis oval, covered with long bristles. Apophysis posterioris 3 x as long as papilla analis and 1.75 x as long as apophysis anterioris, which is as long as segment 8. Segment 8 longitudinally rectangular, weakly sclerotized, distal half sparsely covered with short bristles, dorsolaterally reinforced by sclerotized band; proximal margin strongly sclerotized, deeply convex, medially broader, caudal margin slightly concave; ventral longitudinal sclerotization spherical. Antrum tubular, shorter than segment 8, densely surfaced by small nodules, anterior section with two crescent-shaped opposite patches. Ductus bursae narrower than antrum. Corpus bursae spherical, with one broad crescent-shaped signum bearing two strongly sclerotized thorn-like protuberances and two leaf-shaped posterior signa of equal size.

**Biology.** The biology is unknown. The type material was collected at light.

**Etymology.** The specific epithet refers to the flight period in April.

**Distribution.** Known only from one locality in the Anti-Atlas Mountains at an altitude of 1010 m.

***Pleurota dalilae* Tabell, sp. nov.**

Barcode Index Number: BOLD:ADB1135

Table 1, Figs. 21–22, 42, 59, 65, 66

**Type material.** Holotype ♀ (GP 5914 J. Tabell, DNA sample 26143 Lepid Phyl): Tunisia, 2 km E El Kef, N36.1722 E8.7327, 8.V.2018, J. Tabell leg. (coll. MZH), BOLD sample ID: MM26143, <http://id.luomus.fi/GBT.4> Paratypes: 3 ♂ (GP 5920 J. Tabell, DNA sample 26142 Lepid Phyl; DNA sample 26258 Lepid Phyl), same collecting data as holotype (coll. TAB); 4 ♂ (DNA sample 24829 Lepid. Phyl; DNA sample 24828 Lepid Phyl [barcoding failed]; DNA sample 24830 Lepid Phyl [barcoding failed]; DNA sample 24831 Lepid Phyl [barcoding failed]), Tunisia, Atlas Mts, 40 km SE Le Kef, near El Ksour village, 2.V.2000, K. Nupponen leg. (colls. NUP and TAB); 21 ♂ (GP 5910 J. Tabell, DNA sample 26259 Lepid Phyl; DNA sample 26260 Lepid Phyl; GP 5917 J. Tabell, DNA sample 26262 Lepid Phyl), Tunisia, 13.5 km ESE Maktar, 810 m, N35.8022 E9.3386, 7.V.2018, J. Tabell leg. (coll. TAB).

**Diagnosis.** *P. dalilae* is externally similar to *P. bicostella* and *P. lepigrei*, but it is smaller, and the fringes on forewing are darker. In the male genitalia, the posterior lobe of juxta is longer and narrower than in *bicostella*, but shorter than in *lepigrei*. In the female genitalia, the shape of segment 8 (subquadrate in *dalilae*, quadrate in *bicostella*, longitudinally rectangular in *lepigrei*), the shape of antrum (anteriorly expanded in *dalilae*, tapered in *bicostella*, parallel-sided in *lepigrei*) and the size of posterior signa, are distinguishing characters.

**Molecular data.** Seven specimens of *dalilae* were sequenced successfully, resulting in 658 (n=1), 655 (n=1), 654 (n=3), 622 (n=1) and 621 (n=1) bp barcode sequences. The nearest neighbour to *dalilae* is *lepigrei*, with a 2.99 % divergence. The barcodes of *dalilae* exhibit 0.65 % intraspecific variation.

**Description.** Adult. Wingspan 17.8–20.8 mm. Labial palpus off-white, ventrally dark brown, 6.4 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.32 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Antenna brown. Head off-white, thorax and tegula off-white, mixed with pale brown. Forewing white, dispersed with pale ochre, pale grey and pale brown scales, discal spot distinct, discocellular spot small, plical streak indistinct, fringe line distinct; costal line white, moderately broad, from near base to 0.8; subcostal line brown, slightly expanded towards apex. Fringe mixed with white and pale grey. Hindwing pale grey, fringe pale grey, apically white. Abdomen pale grey, slightly lustrous, each segment with a transverse row of ochre scales.

Male genitalia. Uncus bell-shaped from ventral view, as long as gnathos, covered with several bristles of different size, apex with long narrow stout protuberance. Gnathos funnel-shaped from ventral view, evenly tapered towards apex, apical third surfaced with scobination, apex stout. Valva slightly upwardly oblique from ventral view, ventral margin medially slightly bulged, costa horizontal, slightly bulged medially; cucullus thimble-shaped; sacculus moderately broad, covered with several bristles; valval lobe well delineated, crescent-shaped, surfaced by several nodules with bristles. Juxta tuning-fork-shaped; posterior lobe exceeding the base of uncus. Phallus slightly arched, parallel-sided, with one plate-shaped weakly sclerotized cornutus and a patch of small spines.

Female genitalia. Papilla analis elongate, narrow, densely covered with bristles of different size. Apophysis posterioris 2.9 x as long as papilla analis and 1.5 x as long as apophysis anterioris, which is 1.3 x as long as segment 8. Segment 8 subquadrate, dorsolaterally sclerotized by a narrow band, proximal margin evenly convex, broadly sclerotized, caudal margin slightly concave, lined with several long bristles; ventral longitudinal sclerotization club-shaped. Antrum as long as segment 8, anteriorly expanded, membranous, with two small sclerotized plates. Ductus

bursae short and broad. Corpus bursae ovoid, large, with one wide arched signum bearing two narrow and long protuberances, and two leaf-shaped posterior signa with broad base and narrow spine.

**Biology.** Unknown. The specimens collected by the first author were netted in *Pinus* forests, lower vegetation dominated by *Cytisus* sp. (Fabaceae) in El Kef and *Salvia rosmarinus* (Lamiaceae) near Maktar.

**Etymology.** The species is named in honour of Tunisian scientist Dr. Dalila Haouas.

**Distribution.** Tunisia, known from two localities in Kef Governorate near the Algerian border.

**Results.** The series from near Maktar was collected with *P. illucidella*.

***Pleurota karsholti* Tabell, sp. nov.**

Barcode Index Number: BOLD:ADA1412

Table 1, Figs. 23–24, 43, 60, 65, 66

**Type material.** Holotype ♀ (GP 5511 J. Tabell, DNA sample 24608 Lepid Phyl): Morocco, High Atlas, 9 km NW Ouirgane, N31°12'24" W8°4'33", 30.V–3.VI.2015, 970 m, C. Hviid, O. Karsholt & K. Larsen (coll. ZMUC), BOLD sample ID: MM24608. Paratypes: 4 ♂ (GP 5510 J. Tabell, DNA sample 24606 Lepid Phyl; DNA sample 24607 Lepid Phyl), 2 ♀ (DNA sample 24925 Lepid Phyl), same collecting data as holotype (colls. ZMUC and TAB).

**Other material.** 9 ♂ (GP 5696 J. Tabell; DNA sample 25605 Lepid Phyl; DNA sample 25606 Lepid Phyl), Morocco, Settatt Prov., 2.5 km E Sidi Said Maachou, 100 m, N33.14137 W8.09181, 18.V.2016, J. Tabell leg. (coll. TAB).

**Diagnosis.** The moderately narrow, fusiform forewing with short costal line and white ground colour with irroration of brown scales characterize *karsholti*. In the genitalia, it resembles *P. monochroma*. In the male genitalia the shape of uncus (more triangular in *monochroma*) and gnathos (broader in *monochroma*) and slightly longer posterior lobe of juxta are distinguishing characters. The female genitalia of *karsholti* are similar to those of *P. dalilae*, but the proximal margin of segment 8 is markedly narrower. The female of *monochroma* is unknown.

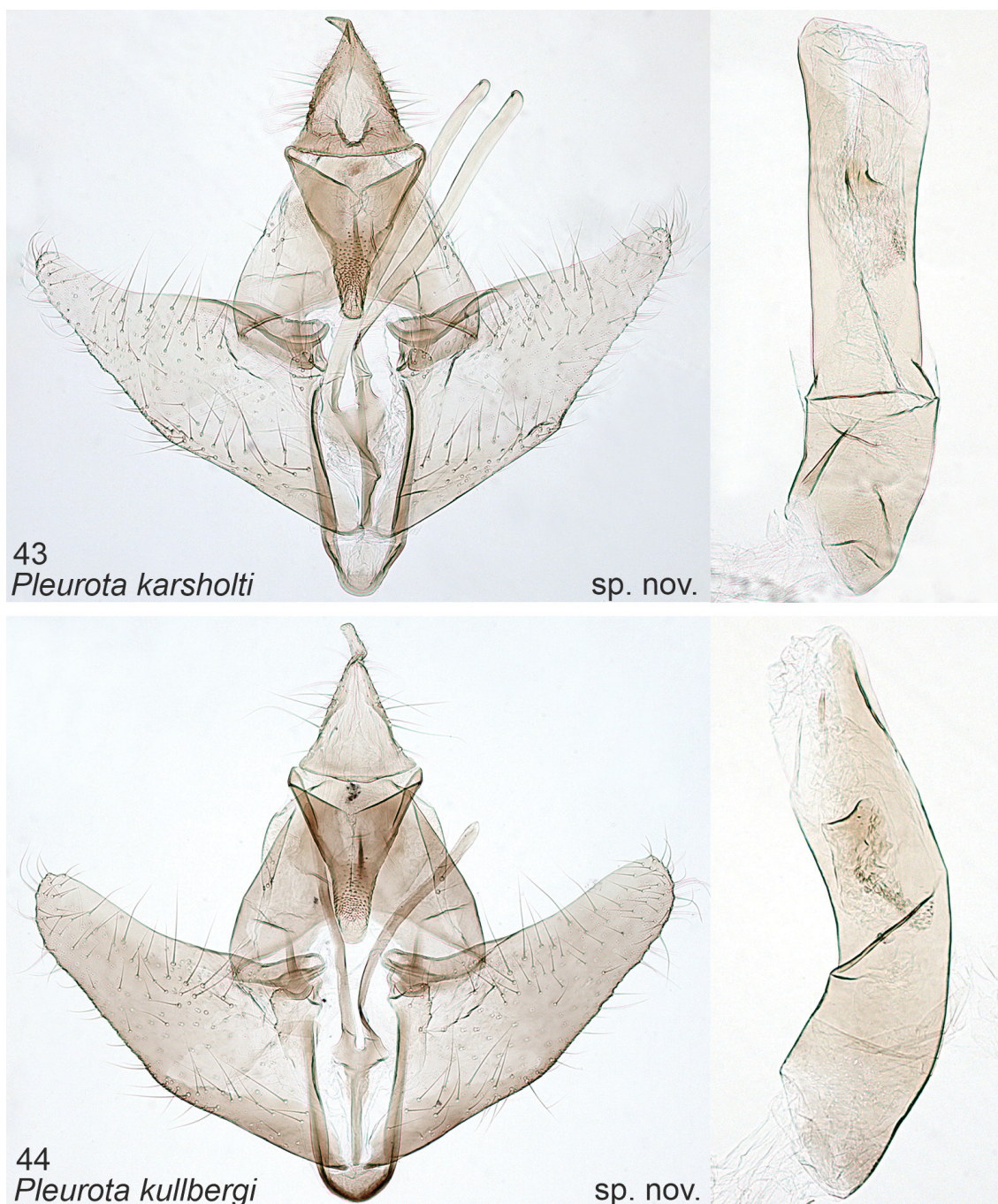
**Molecular data.** Six specimens of *karsholti* were sequenced, resulting in a 658 bp, full-length barcode sequence for all specimens. The nearest neighbour to *karsholti* is *monochroma*, with a 5.93 % divergence (Table 1). There exists a 0.93 % barcode gap between the two known populations from Ouirgane and Sidi Said Maachou (see *Note*), but no intraspecific variation within these clusters (n=4 and n=2, respectively).

**Description.** Adult. Wingspan 16.8–18.7 mm. Labial palpus long, 8.4 x diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.33 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres, white, below mixed with brown scales. Antenna pale grey, basally off-white. Head, thorax and tegula white. Forewing fusiform, white, scattered with fuscous and brown scales, in distal half forming weak stripes, blackish brown discal and plical spots distinct, discocellular spot small, outer margin with several dark flecks; costal line white, from base to 0.66, widest at middle; subcostal line brown, gradually widened from base to near apex, upper edge at proximal half lined with dark brown scales, distal half mixed with white and dark brown scales; dorsal fringe white, basally brown. Hindwing pale grey, fringe pale yellowish brown, apically white.

Male genitalia. Uncus bell-shaped from ventral view, slightly shorter than gnathos, covered with several bristles, apex with long, narrow and blunt protuberance. Gnathos funnel-shaped from ventral view, broad, distal half surfaced with scobination, apex stout. Valva conical, costa slightly concave. Sacculus moderately broad, surfaced with long bristles. Anterior extension of juxta slightly swollen, median plate swollen; posterior lobe exceeding the base of uncus, apex with a shallow triangular tooth; valval lobe small, covered with a few short bristles, outer margin undulated. Phallus slightly arched, with one plate-shaped cornutus.

Female genitalia. Papilla analis narrow, elongate, covered with long bristles. Apophysis posterioris 2.8 x as long as papilla analis and 1.5 x as long as apophysis anterioris, which is 1.5 x as long as segment 8. Segment 8 quadrate, dorsolaterally reinforced by sclerotized band, distal half covered with short bristles; proximal margin strongly sclerotized, evenly convex, caudal margin concave, lined with short bristles; ventral longitudinal sclerotization broad. Antrum slightly longer than segment 8, parallel-sided, anteriorly slightly sclerotized with two crescent-shaped sclerotized patches. Ductus bursae membranous, short. Corpus bursae ovoid, with one large arched, medially slightly constricted signum bearing two long protuberances, and two leaf-shaped posterior signa.





**FIGURES 43–44.** Male genitalia of *Pleurota* spp. 43. *P. karsholti* **sp. nov.**, paratype, GP 5510 J. Tabell. 44. *P. kullbergi* **sp. nov.**, holotype, GP 5705 J. Tabell.

**Biology.** The biology is unknown. The specimens were collected at light.

**Etymology.** The species is named in honour of Danish entomologist Ole Karsholt, one of the collectors of the type series.

**Distribution.** Known from two localities in the High Atlas Mountains in Morocco, at an altitude of 100 m and 970 m.

**Note.** A portion of the examined material (specimens from Sidi Said Maachou) is not included in the type series, due to a 0.93 % genetic divergence (see *Molecular data*), and small differences in genitalia. More material from different localities is needed to determine if this possibly represents cryptic diversity. The description and estimates of genetic divergence are based solely on type material.

***Pleurota kullbergi* Tabell, sp. nov.**

Barcode Index Number: BOLD:ADH1724

Table 1, Figs. 25–26, 44, 61, 65, 66

**Type material.** Holotype ♂ (GP 5705 J. Tabell, DNA sample Lepid Phyl 25601): Morocco, Al Haouz, Oukaimeden, 2580 m, 31°12′: -7°50′, 14.V.2011, Jaakko & Anssi Kullberg leg. (coll. MZH), BOLD sample ID: MM25601, <http://id.luomus.fi/GBT.5> Paratypes: 5 ♂, 1 ♀ (GP 5706 J. Tabell, DNA sample Lepid Phyl 25603), same collecting data as holotype; 5 ♂, same collecting data as holotype, but 15.V.2011; 1 ♀, Morocco, Oukaimeden, 2680 m, 31.20116°: -7.87019°, 9–12.V.2015, Jaakko Kullberg leg. (colls. MZH and TAB).

**Diagnosis.** Externally *P. kullbergi* is similar to *P. phaeolepida*, but the labial palp is shorter, the antenna is unicolorous (annulated with white and black in *phaeolepida*), and the costal line of forewing is longer. A broader uncus, longer gnathos, broader and shorter posterior lobe of juxta, and broader cucullus distinguish *kullbergi* from *phaeolepida*. In general, the male genitalia of *kullbergi* are strongly sclerotized. In the female genitalia, long club-shaped ventral sclerotization of segment 8 and moderately small corpus bursae are distinctive.

**Molecular data.** Two specimens of *kullbergi* were sequenced, resulting in a 658 bp, full-length DNA barcode sequence for both specimens. The nearest neighbour to *kullbergi* is *P. dalilae*, with a 5.2 % divergence (Table 1). The barcodes of *kullbergi* exhibit 0.31 % intraspecific variation.

**Description.** Adult. Wingspan male 14.0–17.0 mm, female 13.0–13.9 mm. Labial palp pale grey, mixed with brown scales, ventrally dark brown, 4.8 x longer than diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.27 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Antenna and scape greyish brown. Head pale grey mixed brown, thorax brown, tegula pale fuscous. Forewing greyish brown, dispersed with white scales, especially at apical half; costal line white, narrow, from near base to 0.8; subcostal line brown, parallel-sided; discal and discocellular spots small, brown, at fold a narrow brown stripe from base to plical spot. Fringe concolorous with the forewing. Hindwing grey, fringe pale brownish grey, apically paler. In female fore- and hindwings are narrower. Abdomen dark brownish grey, slightly lustrous, each segment with a transverse row of orange scales.

Male genitalia. Uncus bell-shaped from ventral view, almost as long as gnathos, lined with several long and short bristles, apex with long, narrow and stout protuberance. Gnathos funnel-shaped from ventral view, apex rounded, distal third surfaced with scobination. Anterior margins of tegumen arched. Valva evenly sclerotized, distal half moderately broad, costa upwardly oblique, slightly concave; sacculus covered with a few long bristles; valval lobe small, outer margin sinuous, lined with a few short bristles. Anterior extension of juxta long, median plate angular; posterior lobe narrow, not reaching uncus. Phallus slightly arched, with one plate-shaped cornutus and a strip of small spines.

Female genitalia. Papilla analis narrow, elongate, covered with long bristles. Anterior apophysis 2 x longer than segment 8, posterior apophysis 1.5 x longer than anterior one. Segment 8 quadrate, sclerotized only in two club-shaped narrow lateral patches, distally covered with few short bristles; proximal margin strongly sclerotized, evenly deeply convex, medially slightly broader, caudal margin slightly concave, ventral longitudinal sclerotization club-shaped. Antrum as long as segment 8, tubular, sclerotized, with two crescent-shaped opposite patches of different size. Ductus bursae moderately broad, membranous. Corpus bursae ovoid, with one broad sickle-shaped signum bearing two narrow protuberances, and two thin, leaflike posterior signa of equal size.

**Biology.** The biology is unknown. The specimens were collected by sweeping low vegetation in daytime.

**Etymology.** The species is named in honour of Finnish entomologist Jaakko Kullberg, who collected the type series.

**Distribution.** Known from a single locality, Oukaimeden, in the High Atlas Mountains in Morocco, at an altitude of 2580–2680 m.

***Pleurota monochroma* Tabell, sp. nov.**

Barcode Index Number: BOLD:ACW1898

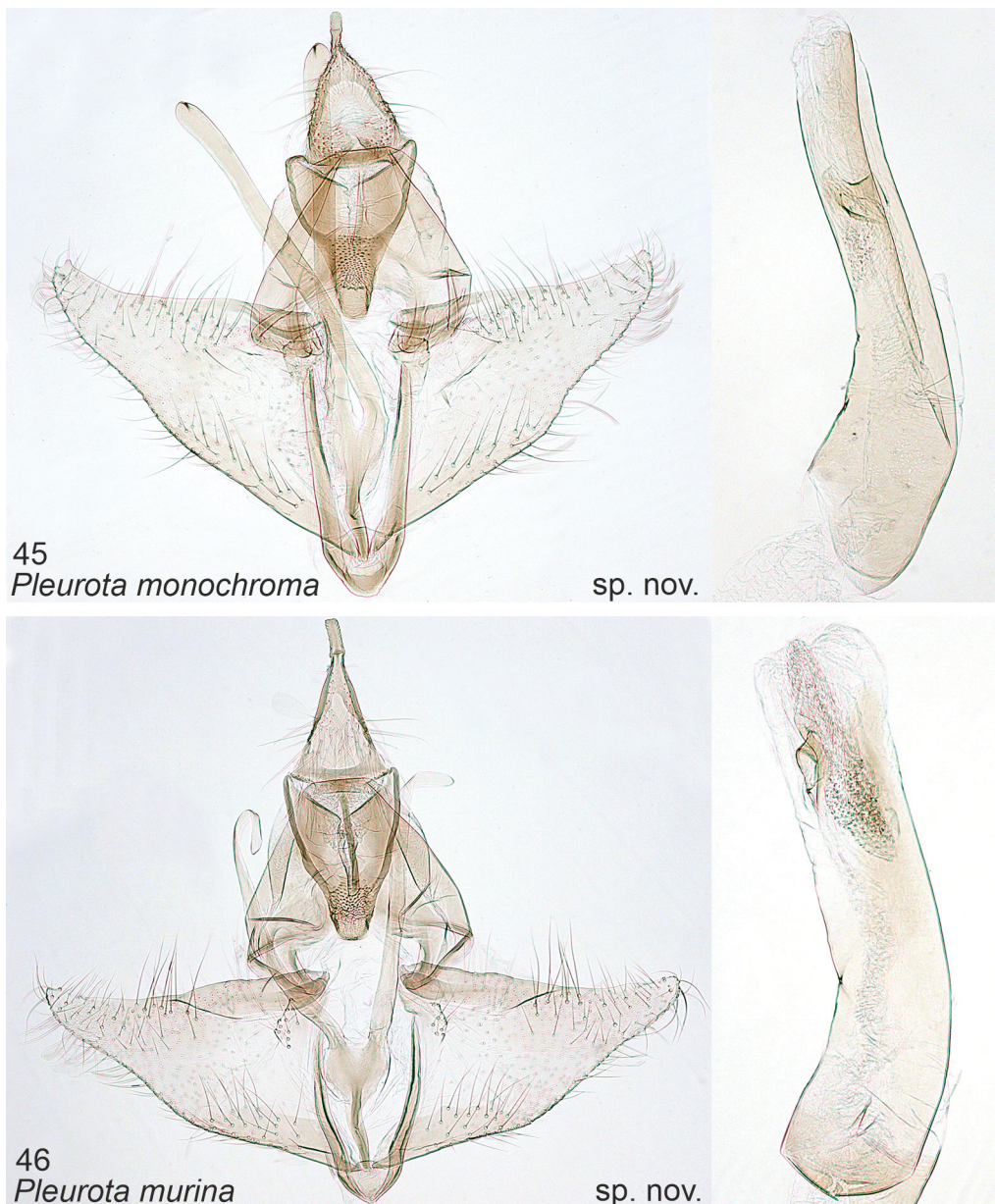
Table 1, Figs. 27, 45, 65, 66

**Type material.** Holotype ♂ (GP 5311 J. Tabell, DNA sample 23689 Lepid Phyl): Morocco, High Atlas, 19 km NNE Ouled Berhil, 1000 m, N30.830 W8.390, 2.V.2013, J. Tabell leg. (coll. MZH), BOLD sample ID: MM23689, <http://id.luomus.fi/GBT.5>



id.luomus.fi/GBT.6 Paratype: 1 ♂ (GP 5072, DNA sample 23693 Lepid Phyl), same collecting data as holotype (coll. TAB).

**Diagnosis.** Externally *P. monochroma* is somewhat similar to *P. gallicella* Huemer & Luquet, 1995 and *P. murina* (white costal line absent), but the forewing is narrower. In the male genitalia of *monochroma*, the valval lobe is triangular (crescent-shaped in *murina*, finger-shaped in *gallicella*), in the phallus the cornutus is broader and the patch of tiny spines smaller. The 8<sup>th</sup> abdominal sternum with three sclerotized patches is characteristic (in *murina* and *gallicella* the 8<sup>th</sup> sternum is uniformly sclerotized). The female of *monochroma* is unknown.



**FIGURES 45–46.** Male genitalia of *Pleurota* spp. 45. *P. monochroma* **sp. nov.**, holotype, GP 5311 J. Tabell. 46. *P. murina* **sp. nov.**, holotype, GP 5505 J. Tabell.

**Molecular data.** Both type specimens of *monochroma* were sequenced successfully, resulting in 658 bp, full-length barcode sequences. The nearest neighbour to *monochroma* is *P. karsholti*, with a 5.93 % divergence (Table 1). The barcodes of *monochroma* exhibit no intraspecific variation.

**Description.** Adult. Wingspan 15.7–17.2 mm. Labial palpus off-white, mixed with pale brown scales, darker below, long and narrow, 6.5 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.24 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres. Head off-white, thorax and tegula off-white, suffused with pale brown. Antenna brown, every second antennomere trapezoidal. Forewing narrow, brownish grey; costal and subcostal lines jointed, a narrow

pale line medially from base to 0.5; median line white, mixed with pale brown, indistinct, from base to 0.4, discal, discocellular and plical spots dark brown; dorsal half paler, dorsal and outer margins edged with dark brown scales. Fringe pale brown, mixed white. Hindwing pale grey, fringe slightly paler. Abdomen slightly lustrous, greyish brown, each segment with a transverse row of ochre scales.

Male genitalia. Uncus triangular from ventral view, slightly shorter than gnathos, lined with few long and several short bristles, apex with long narrow stout protuberance. Gnathos funnel-shaped from ventral view, broad, distal half surfaced with scobination, apex moderately broad, stout and smooth. Ventral margin of tegumen arched. Valva triangular, evenly tapered towards apex, dorsally surfaced with long bristles, in paratype specimen valva tapered strongly towards apex; sacculus covered with long bristles; valval lobe weakly sclerotized, triangular. Median plate of juxta slightly swollen; posterior lobe robust, long, almost reaching apex of uncus. Phallus slightly arched, with a plate-shaped cornutus and a group of tiny spines.

Female genitalia. Unknown.

**Biology.** The biology is unknown. The type series was collected at light in a dry meadow dominated by *Salvia aegyptiaca* L. (Lamiaceae).

**Etymology.** Greek *μονόχρωμος* = having one colour. The specific epithet refers to the colour of the forewing.

**Distribution.** Known only from the type locality in the High Atlas Mountains at an altitude of 1000 m.

### ***Pleurota murina* Tabell, sp. nov.**

Barcode Index Number: BOLD:ADA1306

Table 1, Figs. 28, 46, 65, 66

**Type material.** Holotype ♂ (GP 5505 J. Tabell, DNA sample 24603 Lepid Phyl): Morocco, High Atlas, 9 km NW Ouirgane, N31°12'24" W8°4'33", 30.V.–3.VI.2015, 970 m, C. Hviid, O. Karsholt & K. Larsen (coll. ZMUC), BOLD sample ID: MM24603. Paratypes: 1 ♂ (GP 5875 J. Tabell, DNA sample 24604 Lepid Phyl), Morocco, High Atlas, 6 km NW Ouirgane, N31°12'32" W8°4'48", 30.V.2015, 850 m, C. Hviid, O. Karsholt & K. Larsen; 1 ♂ (DNA sample 24605 Lepid Phyl), Morocco, High Atlas, 7 km S Ouirgane, N31°8'19" W8°5'51", 4.VI.2015, 950 m, C. Hviid, O. Karsholt & K. Larsen (coll. TAB).

**Diagnosis.** Externally *P. murina* is similar to *P. gallicella*, and positive identification requires examination of the genitalia. Compared to *gallicella*, the uncus and gnathos are longer in *murina*, and the phallus contains one wedge-shaped small cornutus and a large patch of tiny spines; in *gallicella*, the cornutus is longer, and the spines are strongly sclerotized, grouped into two narrow strips. The female of *murina* is unknown.

**Molecular data.** All three type specimens of *murina* were sequenced successfully, resulting in 658 bp, full-length barcode sequences. The nearest neighbour to *murina* is *P. lepigrei*, with a 8.08 % divergence (Table 1). The DNA barcodes of *murina* exhibit 0.62 % intraspecific variation.

**Description.** Adult. Wingspan 17.9–18.2 mm. Labial palpus mixed with pale grey, pale brown and dark brown scales, darker below, long and narrow, 6.5 x as long as diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere very short, almost invisible. Head pale grey, thorax and tegula grey, suffused with pale brown. Antenna brown, smooth, antennomeres trapezoidal. Forewing covered with off-white, grey-tipped scales; costal and subcostal lines jointed, a narrow pale brown line medially from base to 0.5; median line off-white, indistinctly edged, from base to 0.6, reaching apex of wing as a hue of stripe, with two linear and one rounded blackish brown spots; dorsal half slightly paler basally; outer margin with a row of blackish brown spots. Fringe grey with a white line. Hindwing and fringe pale brownish grey. Abdomen slightly lustrous, greyish brown, each segment with a transverse row of ochre scales.

Male genitalia. Uncus elongated, triangular from ventral view, as long as gnathos, basal half covered and lined with several long bristles, apex with long, parallel-sided, stout protuberance. Gnathos funnel-shaped from ventral view, moderately narrow, gradually tapered towards apex, distal third surfaced with scobination, apex moderately broad, stout. Valva subtriangular, surfaced dorsally with long bristles, apically with short bristles, ventral margin slightly convex, dorsal margin basally evenly slightly bulged. Sacculus surfaced with long bristles. Median plate of juxta swollen; posterior lobe robust, long, reaching uncus; valval lobe narrow, covered with short bristles, outer margin rounded. Phallus slightly arched, parallel-sided, with a plate-shaped cornutus and a large group of tiny spines.

Female genitalia. Female unknown.



**Biology.** The biology is unknown. The specimens were collected at light on open mountain slopes.

**Etymology.** Lat. *murinus* = grey. The specific epithet refers to the colour of forewing.

**Distribution.** Known from three neighboring localities in the High Atlas Mountains, at an altitude between 850 and 970 m.

***Pleurota paragallicella* Tabell, sp. nov.**

Barcode Index Number: BOLD:AEC9409

Table 1, Figs. 29, 47, 65, 66

**Type material.** Holotype ♂ (GP 6024 J. Tabell, DNA sample 26351 Lepid Phyl): Marokko, H Atlas, obh. Ait Leqak 27.6.2017, 31°14' 17–20"N; 7°49' 24–30"W, Tizi-n-Addi, 2400 m, J. Ratzel, RB, AS, DF leg., ex coll. Ulr. Ratzel, Karlsruhe (coll. MZH), BOLD sample ID: MM26351, <http://id.luomus.fi/GBT.7>

**Diagnosis.** Externally *P. paragallicella* is somewhat similar to *P. ericella* (Duponchel, 1839) (Fig. 15), but the subcostal line is paler brown, the labial palp markedly longer, and the veins in hindwing well visible. In male genitalia, *paragallicella* is close to *P. gallicella* (Fig. 49) with some distinct differences. In *paragallicella*, the gnathos is longer, the posterior lobe shorter, and the valval lobe markedly smaller, subtriangular (in *gallicella* the valval lobe is ear-shaped). The female of *paragallicella* is unknown.

**Molecular data.** The holotype of *paragallicella* was sequenced successfully, resulting in a 656 bp barcode sequence. The nearest neighbour to *paragallicella* is *P. gallicella*, with a 5.13 % divergence.

**Description.** Adult. Wingspan 16.7 mm. Labial palpus long, 8.2 x diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.23 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres, dirty white, scattered with brown and pale beige scales, below dark brown, mixed off-white. Antenna and scape brown. Head, thorax and tegula brown, mixed with fuscous and off-white scales. Forewing dirty white, scattered with pale fuscous and brown scales; costal line off-white, from base to 0.75; subcostal line greyish brown, expanded towards apex, brown, scattered with white and dark brown scales. Fringe greyish brown, apically lighter. Hindwing greyish brown, veins visible, fringe concolorous, apically white.

Male genitalia. Uncus triangular from ventral view, slightly shorter than gnathos, lined with several long and short bristles, apex with stout protuberance. Gnathos funnel-shaped from ventral view, broad, smooth, distal half elongate and covered with scobination, apex stout. Valva oblique from ventral view; cucullus moderately narrow, ventral margin concave; sacculus covered by long bristles; valval lobe very small, subtriangular. Anterior extension of juxta narrow; posterior lobe not reaching the base of uncus. Phallus arched, slightly tapered towards apex, with a large plate-shaped cornutus and numerous robust spines grouped into two bundles of different size.

Female genitalia. Female unknown.

**Biology.** The biology is unknown. The specimen was collected at light on a rocky hillside.

**Etymology.** The specific epithet refers to the close affinity with *gallicella*.

**Distribution.** Known only from the type locality in the High Atlas Mountains at an altitude of 2400 m.

**Note.** Huemer & Luquet (1995) included five *Pleurota* specimens from Tinnel, Morocco into the paratype series of *gallicella*, but these specimens may belong to *paragallicella* (not examined by us). Tinnel is a village situated about 40 km southwest of Tizi n'Addi, the type locality of *paragallicella*.

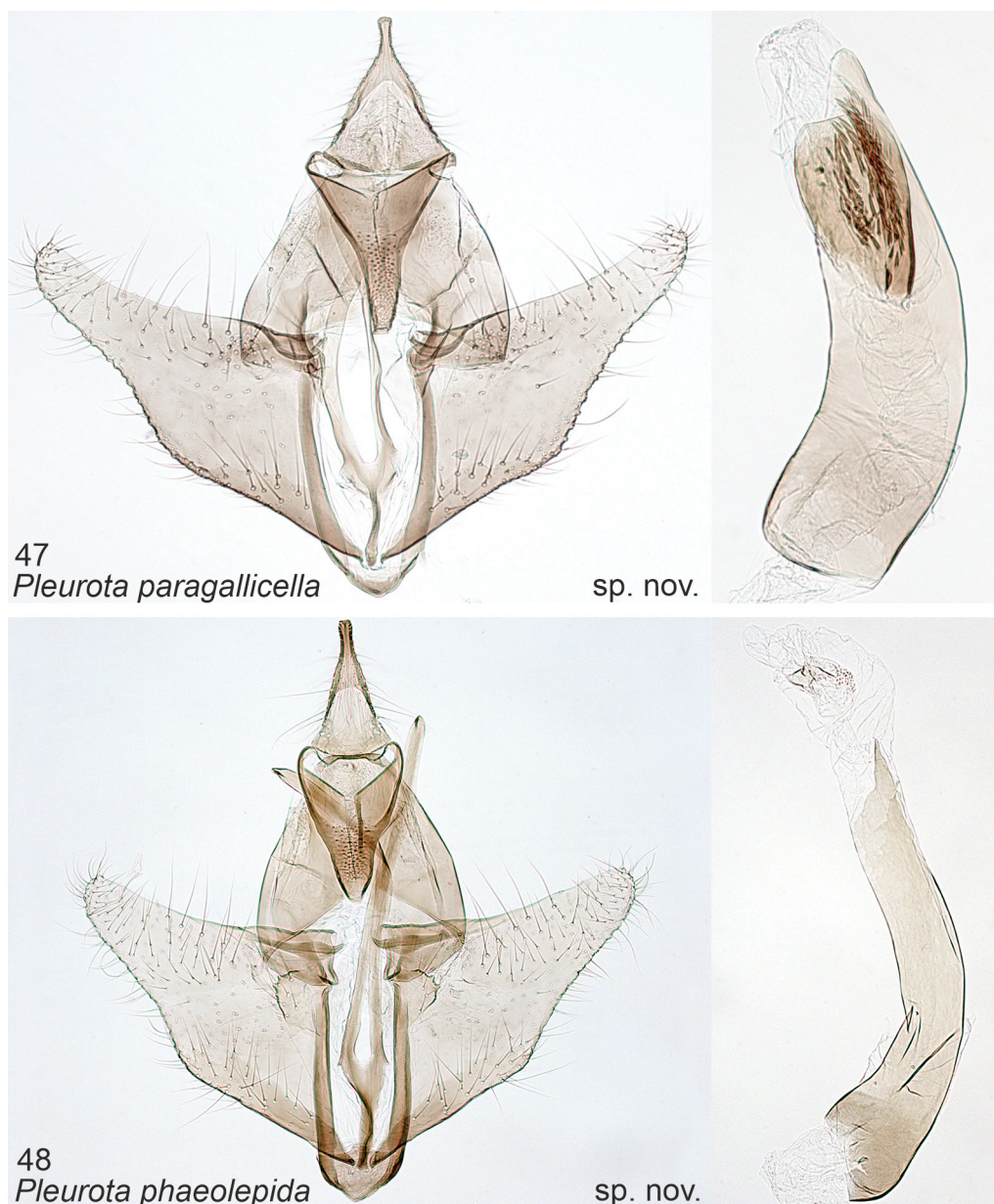
***Pleurota phaeolepida* Tabell, sp. nov.**

Barcode Index Number: BOLD:ACW1989

Table 1, Figs. 16, 48, 62, 65, 66

**Type material.** Holotype ♂ (GP 5777 J. Tabell, DNA sample 24524 Lepid Phyl): Morocco, Taroudant Prov., High Atlas, 1340 m, 1.5 km ENE Ait Oublal, N30.830 W8.404, 16.IV.2015, J. Tabell leg. (coll. MZH), BOLD sample ID: MM24524, <http://id.luomus.fi/GBT.8> Paratypes: 1 ♂ (GP 5453 J. Tabell, DNA sample 23749 Lepid Phyl), same collecting data as holotype (coll. TAB); 1 ♂ (GP 5877 J. Tabell, DNA sample 26234 Lepid Phyl), 2 ♀ (GP 5806 J. Tabell, DNA sample 26233 Lepid Phyl; GP 5876 J. Tabell, DNA sample 26232 Lepid Phyl), Morocco, High Atlas, 6 km NW Ouirgane, road to Amizmiz, 31°12'29"N 8°4'23"W, 1.–2.V.2016, 1050 m, C. Hviid, K. Larsen & D. Nilsson leg. (colls. ZMUC and TAB).

**Other material.** 1 ♂ (DNA sample 24594 Lepid Phyl, abdomen missing), Morocco, Anti-Atlas, Tiznit Prov., 40 km SE Tiznit, 1130 m, 15.IV.2015, N29.546 W9.352, J. Tabell leg.; 1 ♂ (GP 5802 J. Tabell, DNA sample 26334 Lepid Phyl), Morocco, Anti-Atlas, Sous-Massa-Drâa: Idikl 16 km E Tafraoute, 29°44'00"N 08°50'40"W, 1580 m, 8.–10.III.2017, C. Hviid, O. Karsholt, K. Larsen, D. Nilsson [leg.] (coll. TAB).



**FIGURES 47–48.** Male genitalia of *Pleurota* spp. 47. *P. paragalicella* sp. nov., holotype, GP 6024 J. Tabell. 48. *P. phaeolepida* sp. nov., holotype, GP 5777 J. Tabell.

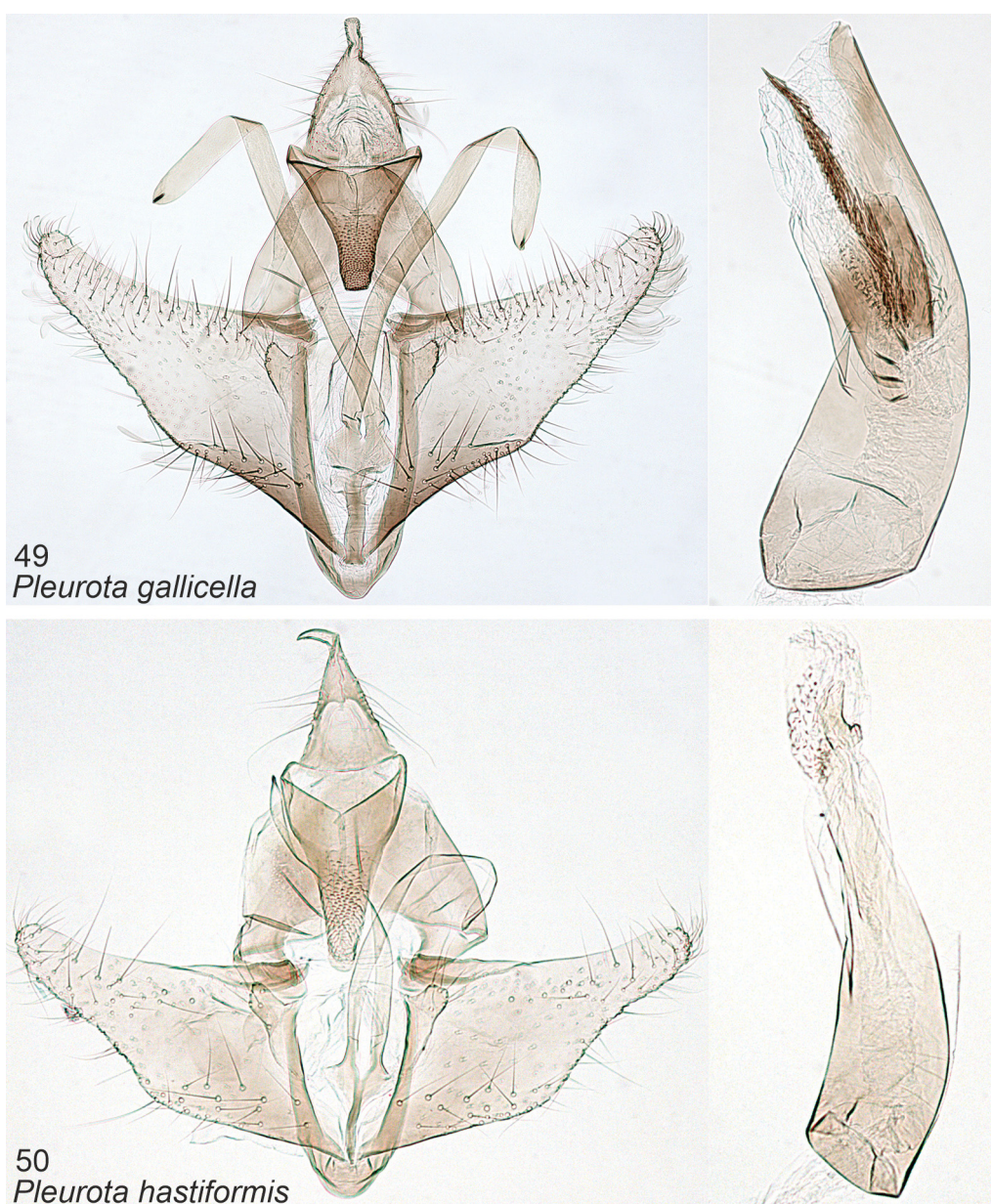
**Diagnosis.** *P. phaeolepida* resembles *P. kullbergi*, but the labial palp is longer, the antenna is annulated (unicolorous in *kullbergi*), and the white costal line in the forewing is shorter. In the male genitalia, narrower uncus, shorter gnathos, narrower and longer posterior lobe of juxta, and narrower cucullus distinguish *phaeolepida* from *kullbergi*. In the female genitalia, long apophyses distinguish *phaeolepida* from other species of the *bicostella* species group.

**Molecular data.** Five type specimens of *phaeolepida* were sequenced successfully, resulting in 658 bp, full-length barcode sequences for two specimens, and fragments of 654, 653 and 651 bp for the remaining specimens. The nearest neighbour to *phaeolepida* is *P. monochroma*, with an 8.01 % divergence (Table 1). The barcodes of *phaeolepida* exhibit 0.31 % intraspecific variation. Furthermore, two non-type specimens were sequenced, but only genetic data of type specimens were used in calculating genetic divergences (see *Note*).



**Description.** Adult. Wingspan 15.0–17.1 mm. Labial palpus long, 6.4 x diameter of eye (1<sup>st</sup> and 2<sup>nd</sup> palpomeres), 3<sup>rd</sup> palpomere 0.39 x length of 1<sup>st</sup> and 2<sup>nd</sup> palpomeres, dirty white mixed with dark brown scales, 3<sup>rd</sup> palpomere white and light brown. Antenna annulated with dirty white and black, basally covered with off-white and fuscous scales, scape brown, below white. Head white mixed with brown, thorax and tegula white, mixed fuscous. Forewing covered with fuscous, brown and white scales, grey ground colour weakly visible, dark brown small spots forming two longitudinal disjointed lines, one between discal and discocellular spots, another from base to plical spot, outer margin with few dark brown scales; costal streak white, narrow, from base to 0.6; subcostal stripe brown, tinged grey, apically scattered with white scales, slightly widened from base to apex. Short dorsal fringe white, longer one grey, white-tipped. Hindwing and fringe grey, apically white. Abdomen lustrous, grey, each segment with a transverse row of ochre scales.

Male genitalia. Uncus elongate, bell-shaped from ventral view, slightly shorter than gnathos, lined with several long and short bristles, apex with long blunt protuberance. Gnathos funnel-shaped from ventral view, evenly tapered towards apex, apex rounded, distal half surfaced with scobination. Valva moderately short, tapered towards apex, surfaced with long bristles, ventral margin concave. Sacculus surfaced with long bristles. Valval lobe rounded, covered with a few long bristles, outer margin nodular; posterior lobe of juxta narrow, exceeding the base of uncus, apex with a small shallow tooth. In arched phallus a plate-shaped cornutus and a group of tiny spines.



**FIGURES 49–50.** Male genitalia of *Pleurota* spp. 49. *P. gallicella* Huemer & Luquet, GP 5334 J. Tabell. 50. *P. hastiformis* Walsingham, GP 5597 J. Tabell.

Female genitalia. Papilla analis narrow, elongate, covered with short bristles. Apophyses long; anterior apophysis 2 x as long as segment 8, posterior apophysis 1.5 x as long as anterior one. Segment 8 longitudinally elongate, rectangular, weakly sclerotized, reinforced by dorsolateral rod, distally covered with short bristles; proximal margin U-shaped, caudal margin straight; ventral longitudinal sclerotization narrow. Antrum parallel-sided, slightly shorter than segment 8, anterior half more sclerotized. Ductus bursae parallel-sided, as long as antrum. In oval corpus bursae one crescent-shaped signum bearing two thorn-like protuberances and two small leaf-like signa of different size.

**Biology.** The biology is unknown. The holotype and one paratype were netted in the afternoon in the *Artemisia* heathland.

**Etymology.** Greek *φαιός* = grey, *λεπίδος* (genitive) = scale. The specific epithet refers to the colour of forewing.

**Distribution.** Known from the High Atlas Mountains, at an altitude of 1050–1340 m.

**Note.** We also studied two male specimens, collected from the Anti-Atlas Mountains, which diverge genetically 1.08 % and 1.39 % from the type specimens. These specimens are not included in the type series. More material is needed to determine if there exists possible cryptic diversity.

**TABLE 1.** Interspecific mean Kimura 2-parameter divergences (%) among members of the *Pleurota bicostella* species group, based on the analysis of the DNA barcode sequence of the COI gene. Maximum intraspecific distances are shown in grey cells. Number of examined specimens are given in parentheses.

	<i>bic</i>	<i>and</i>	<i>ara</i>	<i>ill</i>	<i>lep</i>	<i>aga</i>	<i>apr</i>	<i>dal</i>	<i>kar</i>	<i>kul</i>	<i>mon</i>	<i>mur</i>	<i>par</i>	<i>pha</i>
<i>bicostella</i> (20)	1.08	8.95	10.06	8.68	5.56	8.97	9.32	6.06	7.92	7.23	8.1	8.77	8.12	9.84
<i>andalusica</i> (6)		1.24	8.94	8.16	7.74	10.55	11.27	7.94	7.74	7.91	7.91	9.3	7.45	10.94
<i>aragonella</i> (4)			0	9.58	8.78	10.7	12.16	9.19	11.09	11.43	10.88	11.77	10.03	13.07
<i>illucidella</i> (2)				0	6.93	8.87	10.38	6.8	8.16	6.29	7.81	9.2	7.67	10.55
<i>lepigrei</i> (10)					2.66	7.94	9.01	2.99	6.41	6.14	6.92	8.08	7.62	9.58
<i>agadirensis</i> (2)						0.64	2.79	8.63	9.11	9.66	8.91	10.53	9.46	10.07
<i>aprilella</i> (3)							0.15	9.51	9.55	10.18	9.53	11.27	11.15	11.49
<i>dalilae</i> (7)								0.65	6.45	5.2	7.42	9.3	8.09	9.73
<i>karsholti</i> (4)									0.93	8.43	5.93	8.59	9.0	8.68
<i>kullbergi</i> (2)										0.31	8.44	10.52	7.97	9.52
<i>monochroma</i> (2)											0	10.18	8.67	8.01
<i>murina</i> (3)												0.62	10.04	12.57
<i>paragalicella</i> (1)													N/A	10.43
<i>phaeolepida</i> (5)														0.31

## Discussion

The genus *Pleurota* was revised by Back (1973). He did not give much importance to seemingly moderately small differences in genitalia structure or in external appearance, although in some cases the differences were obvious and significant. As a result, he synonymized several species (three species to *P. bicostella*) and described new subspecies (two subspecies for *P. bicostella*). Our study demonstrates that in the *P. bicostella* species group minor genitalia differences are taxonomically significant when correlated with differences in wing pattern and shape and with genetic barcodes. Based on both morphological and genetic divergence, we propose that all of his synonymizations be reversed, and the subspecies described by him be raised to species level. We emphasize that in this group the DNA barcodes proved highly useful as an additional source of taxonomic information, as they differ quite significantly among species.

Back's influence is also visible in subsequent studies. For example, in Tokár *et al.* (2005), under *P. ericella*, three different species are involved (Figs. 69, 69b, 69d *ericella*; 69a *andalusica*; 69c *bicostella*). Re-examination of the type material of described Pleurotinae taxa is indispensable for further study. Genetic studies hint that several well-known and “easy” species in fact may be species complexes, e.g. *P. aristella* (Linnaeus, 1767), *P. honorella* (Hübner, [1813]) and *P. pungitiella* Herrich-Schäffer, [1854]. We plan to continue our investigations of Pleurotinae and release genetic data that will facilitate the identification of these elegant-looking moths.





51 *Pleurota bicostella*

52 *Pleurota andalusica*

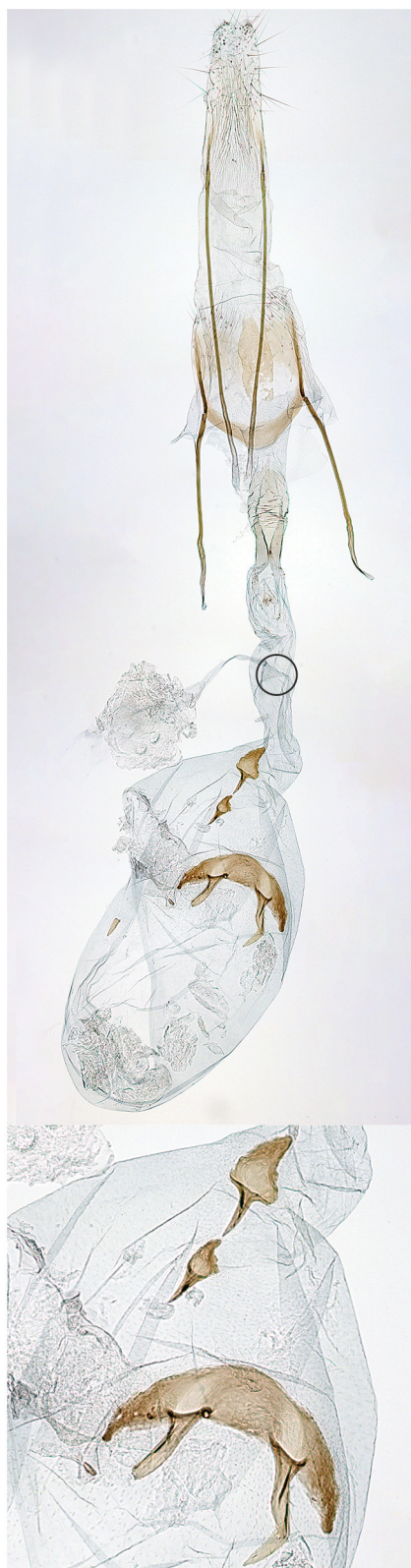
53 *Pleurota aragonella*

**FIGURES 51–53.** Female genitalia of *Pleurota* spp. 51. *P. bicostella* (Clerck), GP 6026 J. Tabell. 52. *P. andalusica* Back, GP 5879 J. Tabell. 53. *P. aragonella* Chrétien, GP 5878 J. Tabell.

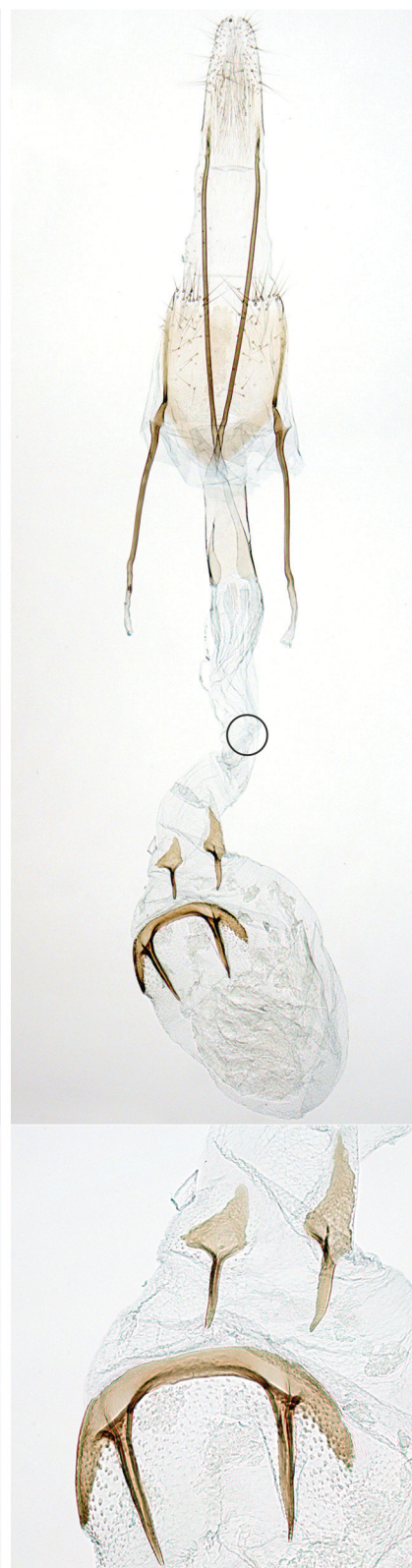




54 *Pleurota asiatica*



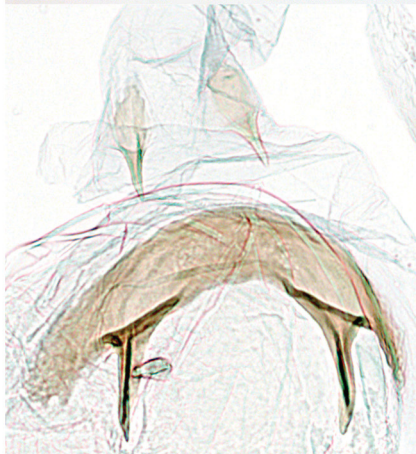
55 *Pleurota illucidella*



56 *Pleurota lepigrei*

**FIGURES 54–56.** Female genitalia of *Pleurota* spp. 54. *P. asiatica* Back, paratype, Genitalpräparat Nr. 00605 H.-E. Back. 55. *P. illucidella* Chrétien, GP 5917 J. Tabell. 56. *P. lepigrei* Lucas, GP 5444 J. Tabell.

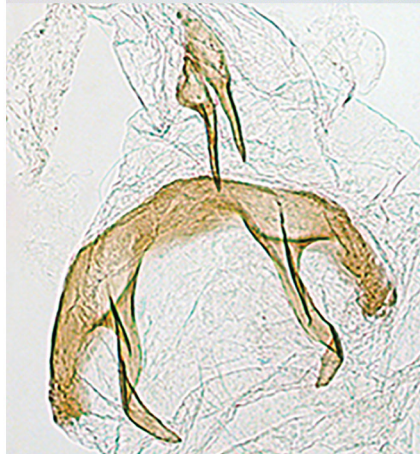
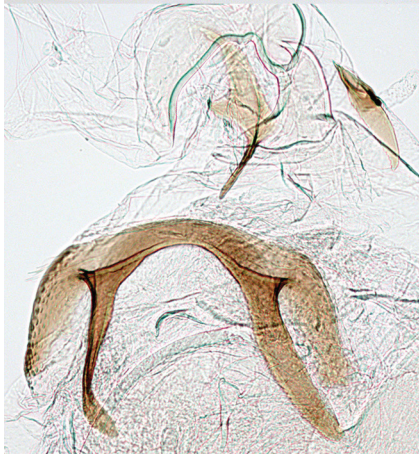
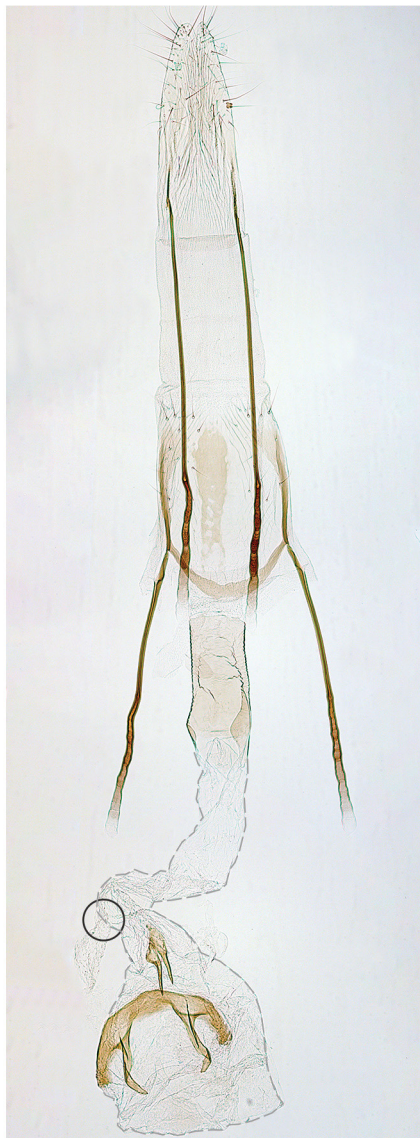
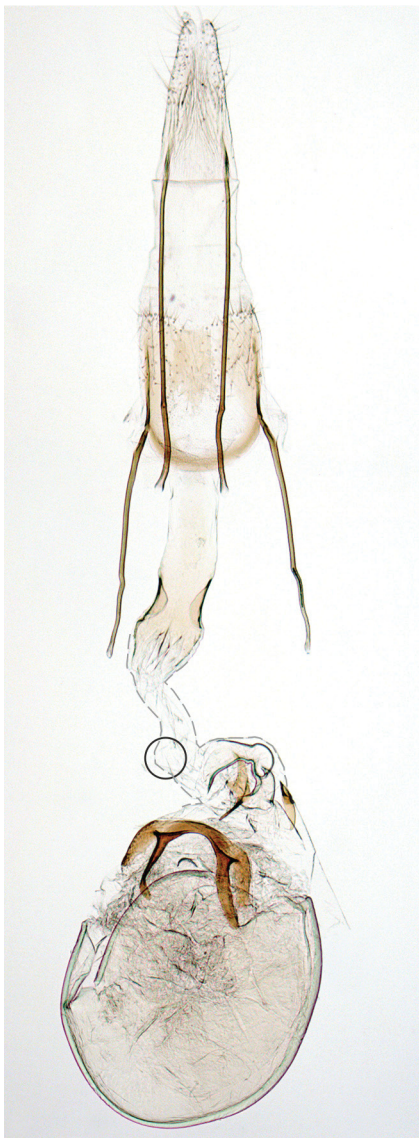




57 *Pleurota agadirensis* sp. n. 58 *Pleurota aprilella* sp. n. 59 *Pleurota dalilae* sp. n.

**FIGURES 57–59.** Female genitalia of *Pleurota* spp. 57. *P. agadirensis* **sp. nov.**, paratype, GP 5761 J. Tabell. 58. *P. aprilella* **sp. nov.**, holotype, GP 5773 J. Tabell. 59. *P. dalilae* **sp. nov.**, holotype, GP 5914 J. Tabell.

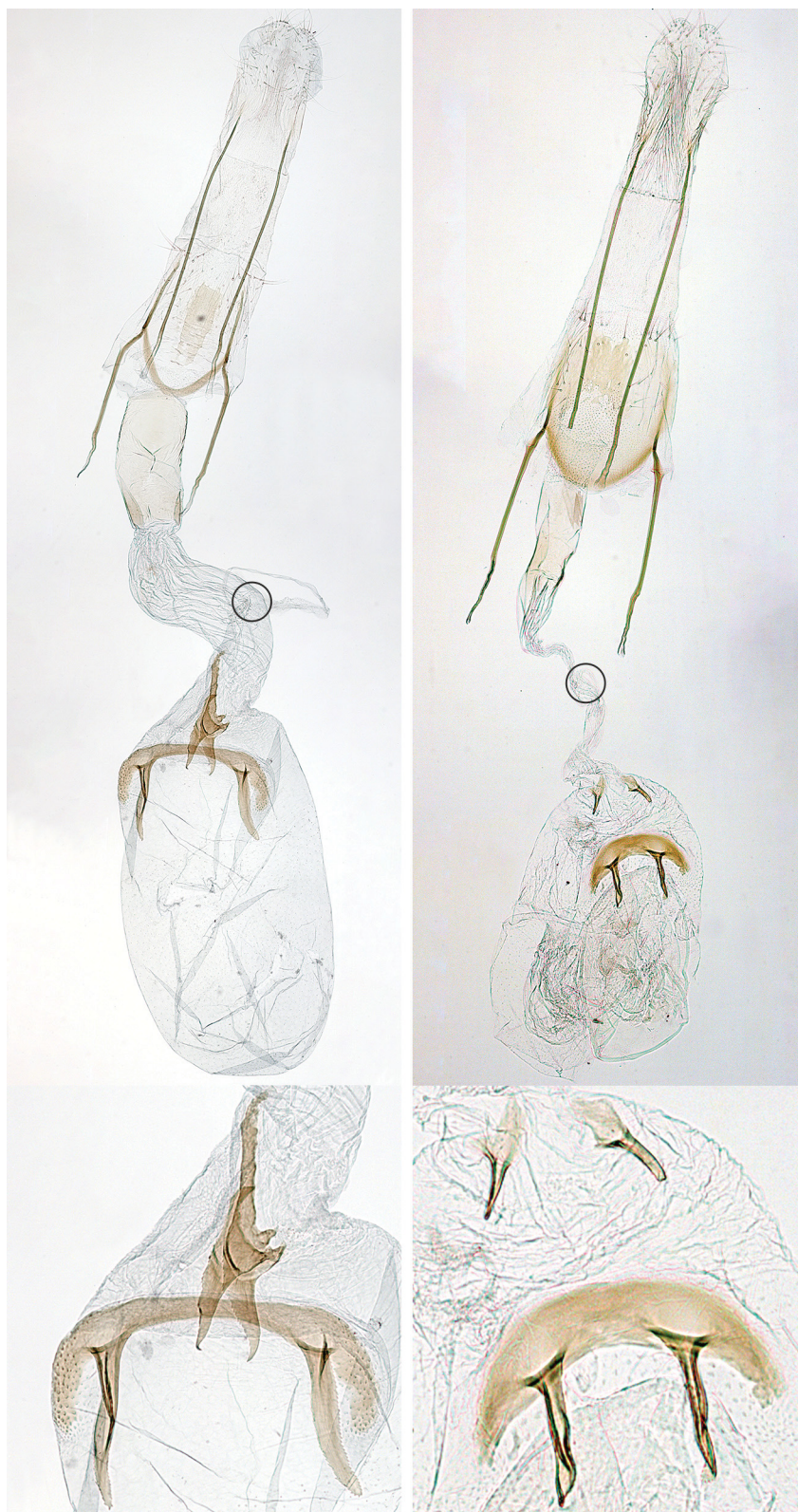




60 *Pleurota karsholti* sp. n.    61 *Pleurota kullbergi* sp. n.    62 *Pleurota phaeolepida* sp. n.

**FIGURES 60–62.** Female genitalia of *Pleurota* spp. 60. *P. karsholti* **sp. nov.**, holotype, GP 5511 J. Tabell. 61. *P. kullbergi* **sp. nov.**, paratype, GP 5706 J. Tabell. 62. *P. phaeolepida* **sp. nov.**, paratype, GP 5876 J. Tabell.

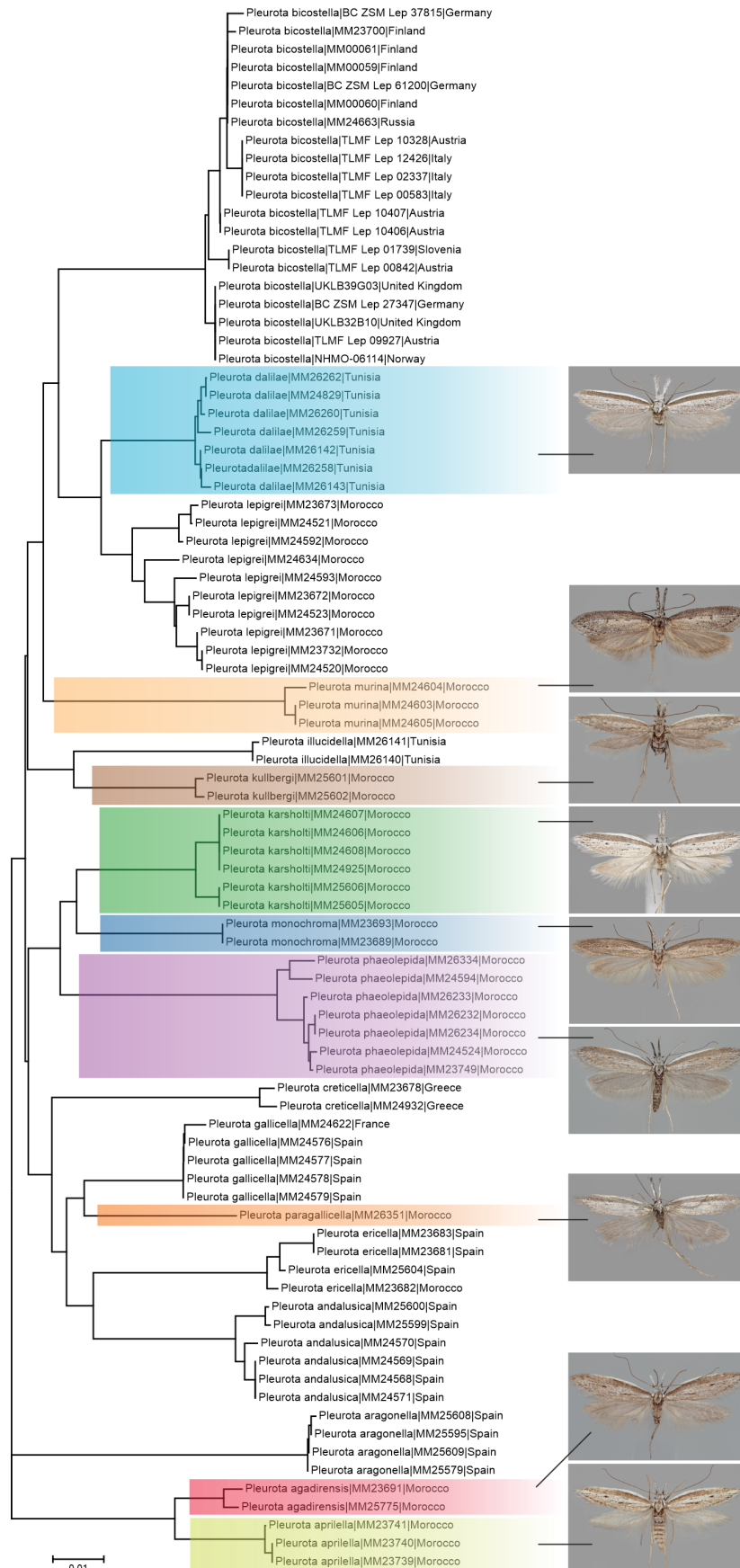




63 *Pleurota gallicella*

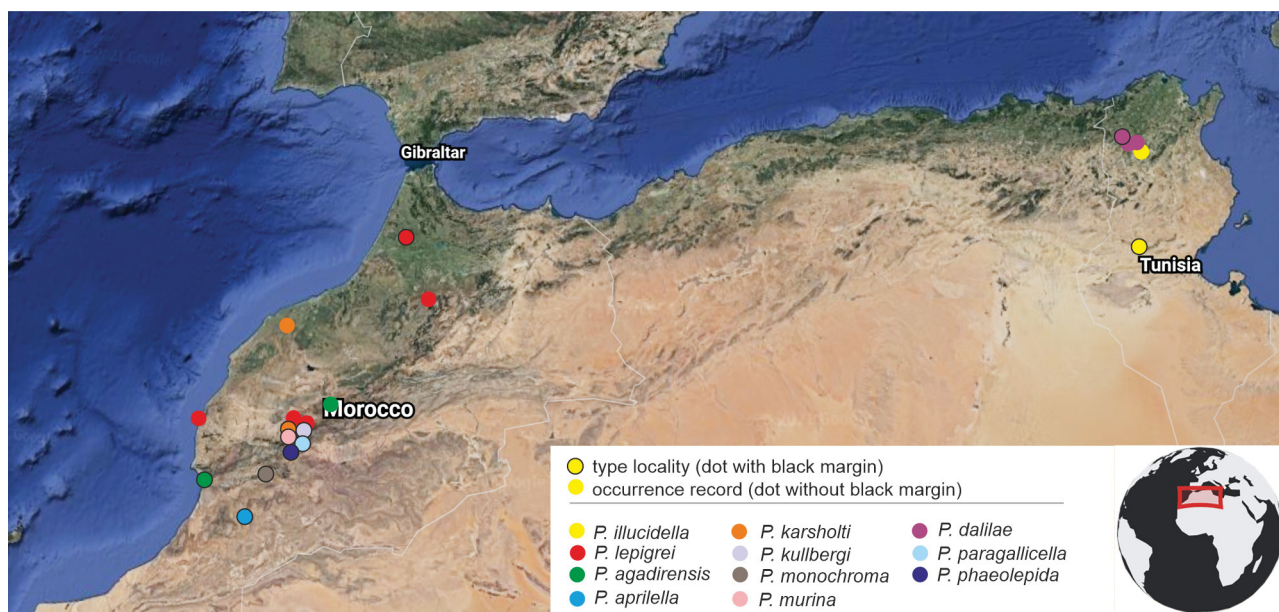
64 *Pleurota hastiformis*

**FIGURES 63–64.** Female genitalia of *Pleurota* spp. 63. *P. gallicella* Huemer & Luquet, GP 5880 J. Tabell. 64. *P. hastiformis* Walsingham, GP 5740 J. Tabell.



**FIGURE 65.** Neighbor-joining tree based on the barcoding fragment of the COI gene (p-distance model) of all available species of the *Pleurota bicostella* species group. “MM26262” etc. are BOLD sample IDs.





**FIGURE 66.** Distribution map of *P. illucidella* Chrétien, *P. lepigrei* Lucas and nine new species of the *P. bicostella* species group. Map based on Google Maps © 2021.

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