



ASTRID LØKEN

Scandinavian species of the genus
Psithyrus Lepeletier
(Hymenoptera: Apidae)

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Scandinavian species of the genus *Psithyrus* Lepeletier (Hymenoptera: Apidae)

P. communis
with antennae
complement

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Keys, synonymy, bibliographies, descriptions, distributions and host relationships are given for the 9 Scandinavian species of *Psithyrus* Lepeletier, viz. *P. bohemicus* (Seidl), *P. vestalis* (Geoffroy in Fourcroy), *P. barbutellus* (Kirby), *P. rupestris* (Fabricius), *P. campestris* (Panzer), *P. quadricolor* Lepeletier, *P. sylvestris* Lepeletier, *P. flavidus* (Eversmann) and *P. norvegicus* Sp. Schneider. The only European species not occurring in Scandinavia, *P. maxillosus* (Klug), is included in the keys for the sake of completeness. Lectotypes are designated for *P. quadricolor meridionalis* Richards and *P. norvegicus*.

Key words: Hymenoptera, Apidae, *Psithyrus*, taxonomy, fauna, host selection, Scandinavia.

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Introduction

The genus *Psithyrus* Lepeletier comprises about 45 species described from the palaearctic, nearctic, oriental and neotropical regions. The bulk of the species is confined to the palaearctic region where 30 taxa at present have specific status (e.g. Popov 1931; Thalcû 1961, 1974a). The greatest diversity is in the east part of the region; only 10 species occur in Europe (Reinig 1981), 9 of which are found in Scandinavia, i.e. Norway and Sweden.

The species in this genus, the cuckoo bumble bees, are social parasites depending on the social bumble bees, *Bombus* Latreille for their existence. They have been recorded from sea level to subalpine/subarctic regions but in general they do not occur at the peripheries of the ranges of their potential hosts.

Variations in climate, structure and topography cause great ecological differences throughout Scandinavia which extends from 55°21'N to

71°11'N (NU 1977). As the inquilines are markedly less abundant than their industrious hosts, information on distribution, geographic variation, ecology, etc. of individual *Psithyrus* spp. requires repeated observations in a variety of habitats.

The present work is an effort to provide a basis for further studies of *Psithyrus*. Owing to the current interest in this host/parasite relationship reliable references to the European host species are included, i.e. references to observations of bumble bee colonies usurped by the *Psithyrus* spp. in question.

Historical review

In dividing the Scandinavian bumble bees into two sections Dahlbom (1832) unintentionally separated the social bumble bees from the inquilines. Lepeletier (1832) subsequently claimed that the taxa listed in Dahlbom's *divisio 2: da con-*

stituted a new genus, which he designated as *Psithyrus*. He also pointed out that species in the new genus were social parasites in which the females lack a pollen-collecting apparatus. Dahlbom's *divisio 2:da* comprises the following 4 species (the synonyms used by Dahlbom in brackets): *P. rupestris* (Fabricius), *P. bohemicus* (Seidl) [= *Bombus aestivalis* (Panzer)], *P. campestris* (Panzer) and *P. barbutellus* (Kirby) [= *B. salutum* (Panzer)].

Zetterstedt (1838) included 3 Swedish *Psithyrus* spp. in his list of *Bombus*, viz. *P. rupestris* (Fabricius), *P. quadricolor* Lepeletier (= *B. frutetorum*: Zetterstedt nec Panzer) and *P. flavidus* (Eversmann) (= *B. autumnalis*: Zetterstedt nec Panzer, the male). Thomson (1872) treats 7 Swedish species, viz. *P. sylvestris* Lepeletier in addition to the species mentioned above. *P. flavidus* is described as a new species designated *P. lissonurus*. Records of *P. norvegicus* Sp. Schneider (Ander 1963) and *P. vestalis* (Geoffroy in Fourcroy) (Løken 1978) bring the total number of Swedish *Psithyrus* to 9 species.

The first observations of the Norwegian *Psithyrus* are found in *Enumeratio Insectorum Norwegicorum* (Siebke 1880). It presents a total of 5 taxa, 4 of which are recognized as species (synonyms used by Siebke in brackets): *P. rupestris*, *P. bohemicus* (= *Apathus vestalis*), *P. quadricolor* (= *A. globosus* Eversmann) and *P. sylvestris*. Further information on the Norwegian inquilines furnished by Sp. Schneider (1898, 1909, 1918) and Lie Pettersen (1901, 1902, 1905, 1907), added 3 more species: *P. campestris*, *P. flavidus* and *P. norvegicus*.

Supplementary contributions to the Scandinavian *Psithyrus* spp. are otherwise referred to in the treatment of the individual species.

Abbreviations referring to museums and collectors

Museums

BCL	Bank collection, London (BML), England
BML	British Museum (Nat.Hist.), London, England
DCL	Dahlbom collection, Lund, Sweden (ZML)
GNM	Göteborg Naturhistoriska Museet, Gothenburg, Sweden
KCC	Kiel collection, Copenhagen (ZMC), Denmark
KCL	Kirby collection, London (BML), England
KMT	Det Kongelige Videnskabers Selskab, Museet, Trondheim, Norway
MAL	Zoological Museum, Academy of Science, Leningrad, USSR
MNB	Museum f. Naturkunde, Humboldt Universität, Berlin, Germany
MNP	Muséum National d'Histoire Naturelle, Paris, France
NMV	Naturhistorisches Museum, Vienna, Austria
NMW	U.S. National Museum, Washington, D.C., U.S.A.
NRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
RNL	Rijksmuseum van Natuurlijke Histoire, Leiden, Netherlands
SCT	Spinola collection, Museo Zoologica, Torino, Italy
SMS	Stavanger Museum, Stavanger, Norway
TCL	Thomson collection, Lund, Sweden (ZML)
TRM	Tromsø Museum, The University, Tromsø, Norway
ZCL	Zetterstedt collection, Lund, Sweden (ZML)
ZMA	Zoölogisches Museum der Universität, Amsterdam, Netherlands
ZMB ¹	Zoologisk Museum, The University, Bergen, Norway
ZMH	Zoologiska Museet, The University, Helsinki, Finland
ZML ¹	Zoologiska Museet, The University, Lund, Sweden
ZMO	Zoologisk Museum, The University, Oslo, Norway
ZMU	Zoologiska Institutionen, The University, Uppsala, Sweden

¹In the list of Norwegian localities ZMB is omitted if the locality is represented by records from Zoologisk Museum, Bergen, only. Likewise, ZML is omitted in the list of Swedish localities.

Material

The present work is based upon a study of approximately 2600 Norwegian and 7300 Swedish specimens. It comprises old and recent museum collections including approximately 1500 individuals collected by me besides a few small private collections. In addition to the main areas for my field work (1939–1969: see Løken 1973) extensive field trips were undertaken in Swedish Lapland and neighbouring provinces (1974, 1976) and in the southeastern lowlands of Norway (1981).

Private collections

CBJS	Cederberg, B., Mora, Sweden
LHAS	Lundberg, H., Stockholm, Sweden
MJEN	Mjelde, A., Enger, Norway
ONNS	Ossiannilsson, F., Uppsala, Sweden
SAGN	Sagvolden, B., Rollag, Norway
SNBS	Svensson, B.G., Uppsala, Sweden
SORN	Solheim, R., Hamar, Norway
TJTS	Tjeder, T., Rättvik, Sweden

! (Autopsy) = specimen seen by the present author.

Methods

Taxonomy

Keys to the genera of Bombinae and to the species of European *Psithyrus* are provided. The papers of Popov (1931) and Pittioni (1939) were consulted. The nomenclature of *Bombus* follows Løken (1973).

Morphological terms, abbreviations

The terminology follows Løken (1973). Abbreviations and additional terms:

A₁₋₁₂ in female, A₁₋₁₃ in male: Individual segments of antennae.

Bt: Basitarsus.

Genal furrow: Border between vertex and upper gena (Fig. 4).

St₁₋₆ in female, St₁₋₇ in male: Individual gastral sternites.

T₁₋₆ in female, T₁₋₇ in male: Individual gastral tergites.

Upper gena: Part of gena outside genal furrow and upper part of eye.

Measurements

The following measurements were taken in both sexes: (a) Rl (Fig. 1); (b) Iw (Fig. 3); (c) Hw = head width; (d) hamuli number; (e) Lh (Fig. 5); (f) Dh (Fig. 5); (g) A₃; (h) A₄; (i) A₅; (j) Or (Fig. 4); (k) Oe (Fig. 4). The measurements of a-f presented by number (N), mean, $\pm$ standard deviation and range, and are given in mm. Those marked g-k are expressed in micrometer units as only the proportions g:h:i and j:k are used.

Interalar width is chosen as an indicator of body size and the following categories were used:

Female: Body large, mean Iw >5.00 mm; body of medium size Iw 4.60–5.00 mm; body small, Iw <4.60 mm.

Male: Body large, mean Iw >3.70 mm; body of medium size, mean Iw 3.55–3.70 mm; body small, mean Iw <3.55 mm.

If not otherwise mentioned the measurements refer to populations in SE Norway and S Sweden.

Distribution

The presentation of maps, list of localities and other references to the occurrence of the species

follow Løken (1973) except that regional division follows NU (1977). Danish and Finnish distributions indicated on the maps are from Hammer (1970) and Pekkarinen et al. (1981).

If not otherwise mentioned the general distribution of the individual species is taken from Popov (1931), Panfilov (1957), Reinig (1971), Tkalc̃ (1974b) and Rasmont (1983).

Biology

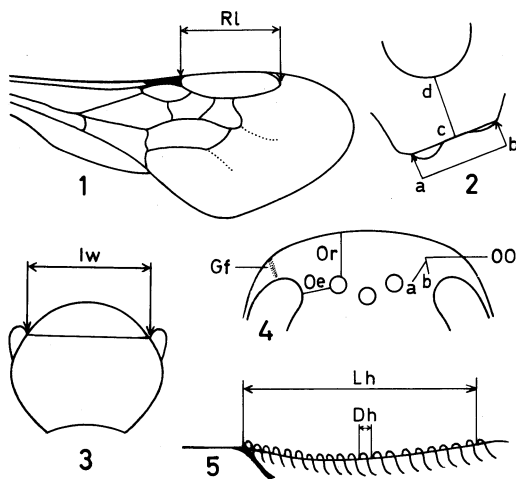
The life cycle of *Psithyrus* is broadly similar to that of *Bombus* (Alford 1975). Being an obligate social parasite, however, *Psithyrus* is unable to build up a colony of its own. The females lack pollen collecting apparatus and wax producing glands; they cannot produce a worker caste and usurp a bumble bee colony to raise the next generation (Pouvreau 1973; Alford 1975). The female inquiline emerges from hibernation later than her host (Postner 1952; Reinig 1973; Husband et al. 1980). She has great success in invading a nest when the colony is not too small but has a sufficient number of workers to rear her brood; if too populous she may lose in fights with the workers (Pouvreau 1973; Alford 1975).

Phenology

The flight activity of hibernating females is generally confined to late spring – early summer; such females are occasionally observed later in the season, however (Alfken 1913; Pittioni & Schmidt 1942; Wagner 1971). The young females are rarely recorded in the field. They emerge approximately at the same time as the males (Husband et al. 1980) and are occasionally observed feeding in flowers during the flight period of the males (Alfken 1913; Pittioni & Schmidt 1942; Wagner 1971).

Classification

The family Apidae is restricted in recent classification to the subfamily Apinae, Meliponinae and Bombinae (Winston & Michener 1977). In the holarctic region the family is represented by Apinae: *Apis* L. and Bombinae: *Bombus* Latreille and *Psithyrus* Lepeletier.



Figs. 1-5. Diagram showing diagnostic characters used. — 1. Right fore wing; Rl = length of radial cell. — 2. Lateral view of malar area; a-b = distal width, c-d = malar space. — 3. Transverse section of thorax; Iw = interalar width. — 4. Facial view of upper part of *Psithyrus* head; Gf = genal furrow, OO = ocellar-orbital field, OOa = impunctate area, OOob = punctured band, Oe = distance from right ocellus to compound eye, Or = distance from ocellus to preoccipital ridge. — 5. Hamuli of right hind wing; Lh = linear distance between lateral hamuli, Dh = distance between hamuli.

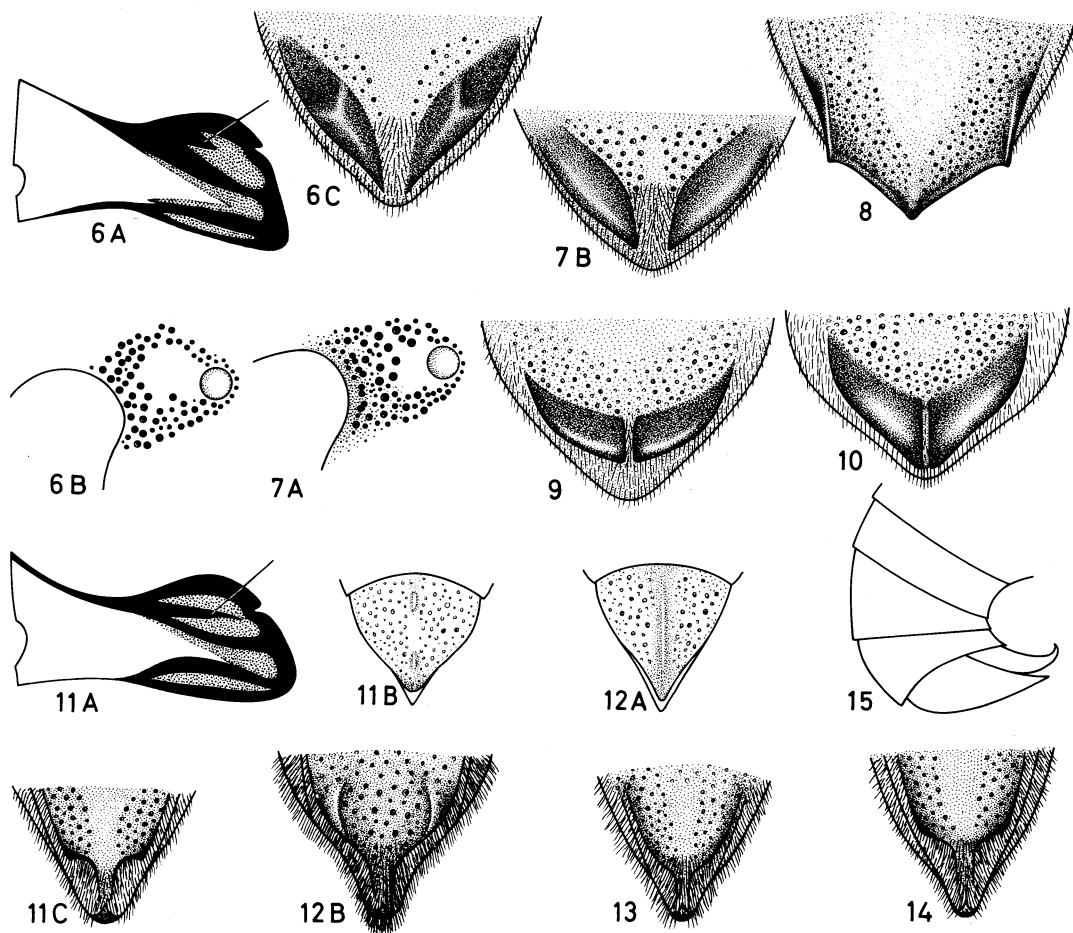
Keys to the European species of *Psithyrus* Lepeletier

FEMALES

1. Malar space shorter than $\frac{2}{3}$ the distal width (Fig. 2). Main keel of mandible poorly developed (Fig. 6A). Hind Bt almost as wide as joining part of tibia. *St*₆ with ridge-like callosities (Figs. 6C, 7B) *Ashtonipsithyrus* Frison 2
- Malar space $\frac{2}{3}$ the distal width or longer. Main keel of mandible prominent (Fig. 11A), at least reaching half way to margin. Hind Bt markedly narrower than joining part of tibia. Callosities of *St*₆ as in Figs. 8-14 3
2. *A*₃ markedly longer than *A*₅, OOob (Fig. 4) as in Fig. 6B. Hind Bt with posterior fringe exceeding $0.5\times$ its greatest width. Callosities of *St*₆ distally pointed (Fig. 6C) *P. (Ashtonipsithyrus) bohemicus* (Seidl) p. 8
- *A*₃ slightly longer than *A*₅, OOob as in Fig. 7A. Hind Bt with posterior fringe not exceeding $0.5\times$ its greatest width. Callosities of *St*₆ slightly further apart, less pointed (Fig. 7B) *P. (Ashtonipsithyrus) vestalis* (Geoffroy in Fourcroy) p. 10
3. Wing black-brown, almost opaque. Callosities of *St*₆ as in Fig. 8. *T*₄₋₆ reddish-haired, otherwise coat black *P. (Psithyrus) rupestris* (Fabricius) p. 14
- Wing lighter, transparent. Callosities of *St*₆ as in Figs. 9-14. Coat differently coloured 4
4. Callosities of *St*₆ large, broad (Figs. 9-10). Tip of gaster not strongly incurved 5
- Callosities of *St*₆ small, narrow (Figs. 11-14). Tip of gaster strongly incurved (Fig. 15) *Fernaldaepsithyrus* Frison 7
5. Main keel of mandible reaching margin or almost so. *T*₆ with close, uniform punctation. *St*₆ with flattened semi-circular callosities (Fig. 9) *Allopsithyrus* Popov 6
- Main keel of mandible reaching about $\frac{2}{3}$ down to margin. *T*₆ with sparser, irregular punctation. Callosities of *St*₆ convex, distally pointed (Fig. 10) ... *P. (Metapsithyrus) campestris* (Panzer) p. 18
6. Wings rather clouded. Hind tibia with longest hairs in posterior fringe shorter than $0.5\times$ its greatest width, hind Bt with longest hairs as long as its width. Coat even, short. Southern European species *P. (Allopsithyrus) maxillosus* Klug
- Wings less clouded, darker distad than basad. Hind tibia with longest hairs in posterior fringe longer than $0.5\times$ its width, hind Bt with longest hairs slightly exceeding its width. Callosities of *St*₆ as in Fig. 9. Coat shaggy, longer *P. (Allopsithyrus) barbutellus* (Kirby) p. 12
7. Main keel of mandible as in Fig. 11A. Scapus shiny. *T*₅ only slightly more sparsely punctured than *T*₃. *T*₆ inconspicuously keeled (Fig. 11B). *St*₆ with angled callosities (Fig. 11C) *P. (Fernaldaepsithyrus) sylvestris* Lepeletier p. 25
- Main keel of mandible rarely reaching distal margin. Scapus dull. *T*₅ markedly more sparsely punctured than *T*₃. Callosities of *St*₆ not angled (Figs. 12-14) 8
8. Hind tibia and Bt with longest hairs in posterior

Key to holarctic genera of Bombinae

1. Antennae 12-segmented. Gaster with 6 visible tergites, the hindmost distally pointed. Sting present Female 2
- Antennae 13-segmented. Gaster with 7 visible tergites, the hindmost distally rounded. Sting absent Male 3
2. Mandible distally truncate. Outer surface of hind tibia flat, distally slightly grooved, hairless except at base and borders. *St*₆ without callosities. Tip of gaster straight. Social species with worker caste *Bombus* Latreille
- Mandible distally oblique (Figs. 6A, 11A). Outer surface of hind tibia convex, covered with hairs. *St*₆ with callosities (Figs. 6-14). Tip of gaster incurved. Inquilinous species, no worker caste *Psithyrus* Lepeletier
3. Head hardly to markedly longer than wide. Outer surface of hind tibia with sparse smooth or feebly branched hairs, posterior fringe longer than the anterior. Genitalia strongly sclerotized *Bombus* Latreille
- Head roundish. Outer surface of hind tibia covered with strongly branched hairs, posterior and anterior fringe about equal in length. Genitalia as in Figs. 16-24, gonostylus and volsella usually membranous *Psithyrus* Lepeletier



Figs. 6–15. — 6. *P. bohemicus* (Seidl) ♀; A = right mandible, B = ocellar-orbital field, C = callosities of sternite 6. — 7. *P. vestalis* (Geoffroy in Fourcroy) ♀; A = ocellar-orbital field, B = callosities of sternite 6. — 8. *P. rupestris* (Fabricius) ♀, callosities of sternite 6. — 9. *P. barbutellus* (Kirby) ♀, callosities of sternite 6. — 10. *P. campestris* (Panzer) ♀, callosities of sternite 6. — 11. *P. sylvestris* Lepeletier ♀; A = right mandible, B = tergite 6, C = callosities of sternite 6. — 12. *P. norvegicus* Sp. Schneider ♀; A = tergite 6, B = callosities of sternite 6. — 13. *P. flavidus* (Eversmann) ♀, callosities of sternite 6. — 14. *P. quadricolor* Lepeletier ♀; callosities of sternite 6. — 15. *Fernaldaepsithyrus* ♀; lateral view of tip of gaster.

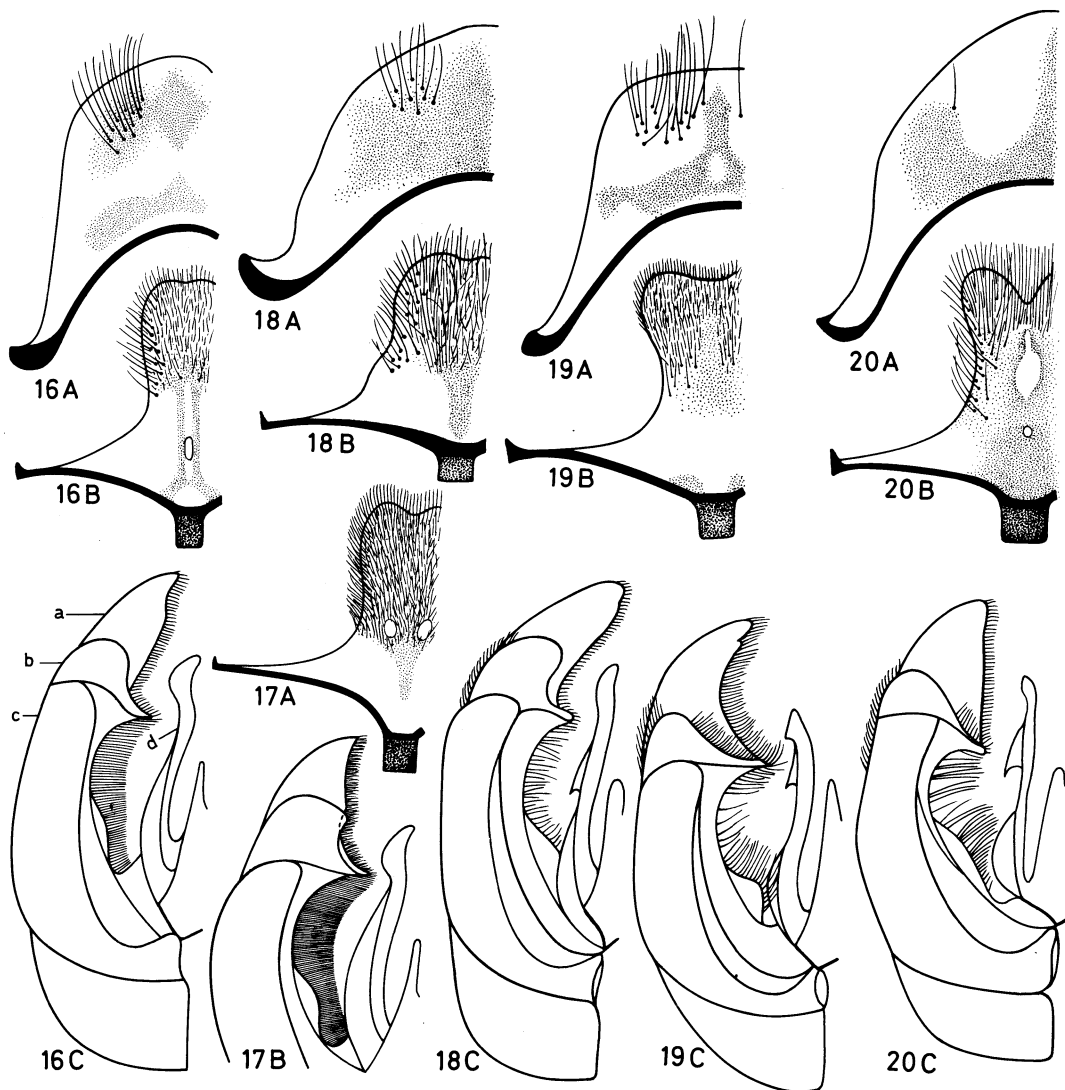
fringe hardly or not exceeding their greatest width.

T_6 keeled (Fig. 12A). Callosities of St_6 as in Fig.

- 12B *P. (Fernaldaepsithyrus) norvegicus* Sp. Schneider p. 36
- Hind tibia and Bt with longest hairs in posterior fringe markedly longer than their greatest width. T_6 inconspicuously or not keeled. Callosities as in Figs. 13–14 9
9. Callosities of St_6 as in Fig. 13. T_4 yellow-haired, T_5 black-haired *P. (Fernaldaepsithyrus) flavidus* (Eversmann) p. 28
- Callosities of St_6 as in Fig. 14. T_{3-5} ferruginous-haired, often with an admixture of whitish hairs .. *P. (Fernaldaepsithyrus) quadricolor* Lepeletier p. 23

MALES

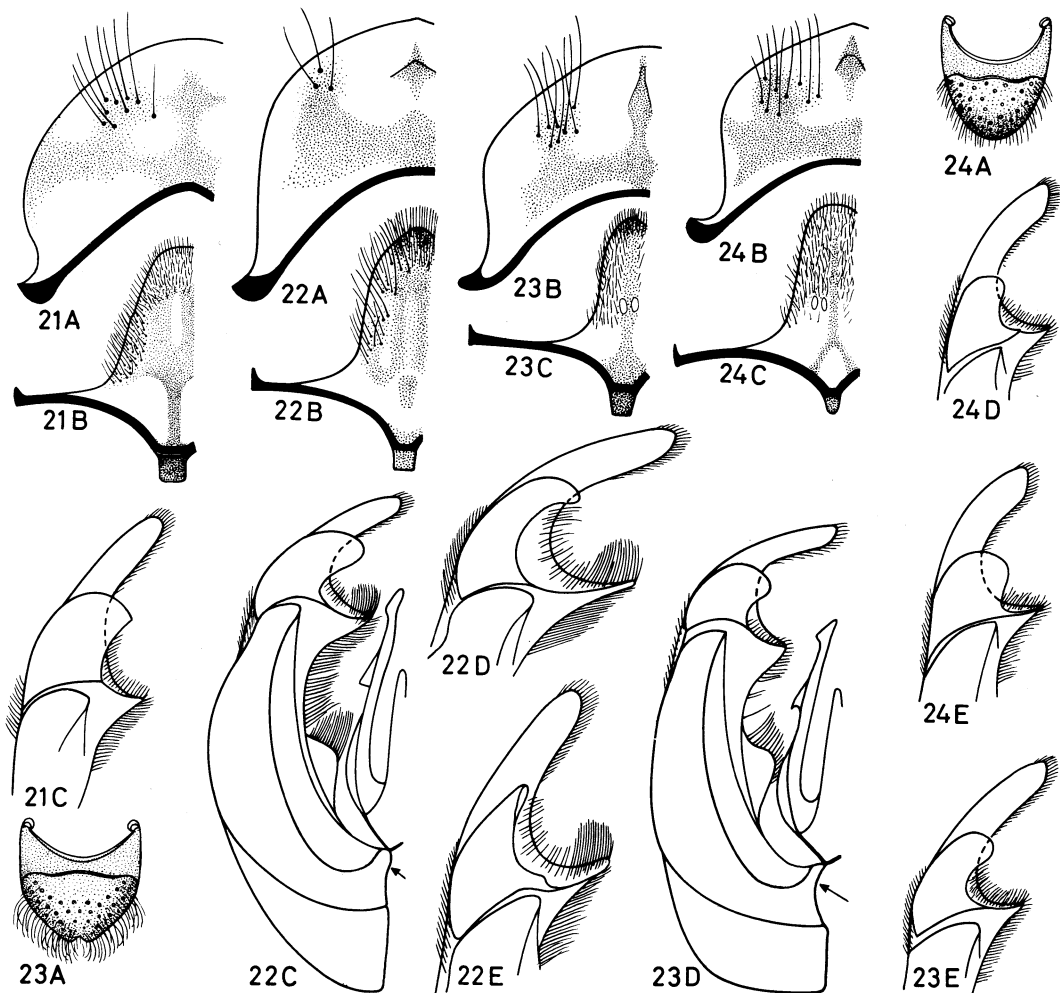
1. Malar space shorter than $\frac{3}{4}$ the distal width. St_{7-8} and genitalia as in Figs. 16–17; penis valve not hooked beneath *Ashtonipsithyrus* Frison 2
- Malar space longer than $\frac{3}{4}$ the distal width. St_{7-8} and genitalia as in Figs. 18–24; penis valve hooked beneath 3
2. A_3 hardly or not longer than A_5 . Hind tibia and Bt with longest hairs in posterior fringe at least as long as their greatest width. St_{7-8} and genitalia as in Fig. 16A–C ... *P. (Ashtonipsithyrus) bohemicus* (Seidl) p. 8
- A_3 markedly shorter than A_5 . Hind tibia and Bt with longest hairs in posterior fringe shorter than their greatest width 3



Figs. 16–20. Right half of male *Psithyrus* sternite 7–8 and genitalia. — 16. *P. bohemicus* (Seidl) ♂; A = sternite 7, B = sternite 8, C = genitalia; a volsella, b gonostylus, c gonocoxite, d penis valve. — 17. *P. vestalis* (Geoffroy in Fourcroy) ♂; A = sternite 8, B = genitalia. — 18. *P. barbutellus* (Kirby) ♂; A = sternite 7, B = sternite 8, C = genitalia. — 19. *P. rupestris* (Fabricius) ♂; A = sternite 7, B = sternite 8, C = genitalia. — 20. *P. campestris* (Panzer) ♂; A = sternite 7, B = sternite 8, C = genitalia.

- test width. St₈ and genitalia as in Fig. 17A–B *P. (Ashtonipsithyrus) vestalis* (Geoffroy in Fourcroy) p. 10
3. Hind Bt longer than 3.5× its greatest width. St_{7–8} and genitalia as in Figs. 18–20 4
- Hind Bt about 3.5× its greatest width. St_{7–8} and genitalia as in Figs. 21–24 *Fernaldaepsithyrus* Frison 7
4. St₆ distally callose with a median deepening. Genitalia as in Fig. 18C. T_{4–5} all or mainly with whitish to yellowish-white hairs *Allopsithyrus* Popov 5

- St₆ distally flattened or feebly, evenly callose. St_{7–8} and genitalia as in Figs. 19–20. T_{4–5} without whitish hairs . 6
5. Hairs of scapus about 1.5× the segment's width. Hind tibia with longest hairs in posterior fringe about 0.5× its greatest width, hind Bt with longest hairs about as long as its greatest width. Coat even. Southern European species *P. (Allopsithyrus) maxillosus* (Klug)
- Hairs of scapus about 2× the segment's width. Hind tibia and Bt with longest hairs in posterior fringe slightly



Figs. 21–24. *Fernaldaepsithyrus* Frison; sternite 6, right half of male sternite 7–8 and genitalia. — 21. *P. quadricolor* Lepeletier ♂; A = sternite 7, B = sternite 8, C = posterior part of genitalia. — 22. *P. norvegicus* Sp. Schneider ♂; A = sternite 7, B = sternite 8, C = genitalia, D–E = posterior part of genitalia. — 23. *P. sylvestris* Lepeletier ♂; A = sternite 6, B = sternite 7, C = sternite 8, D = genitalia, E = posterior part of genitalia. — 24. *P. flavidus* (Eversmann) ♂; A = sternite 6, B = sternite 7, C = sternite 8, D–E = posterior part of genitalia.

- or not exceeding their greatest width. St_{7–8} and genitalia as in Fig. 18A–C. Coat shaggy *P. (Allopsithyrus) barbutellus* (Kirby) p. 12
6. A₃ slightly shorter than A₅. Hind Bt parallel-sided, more than 4× longer than wide. St_{7–8} and genitalia as in Fig. 19A–C. T_{4–6} with reddish hairs *P. (Psithyrus) rupestris* (Fabricius) p. 14
- A₃ markedly shorter than A₅. Hind Bt shorter than 4× its greatest width. St_{7–8} and genitalia as in Fig. 20A–C. T_{4–6} without reddish hairs *P. (Metapsithyrus) campestris* (Panzer) p. 18
7. St₆ distally broadly rounded. St_{7–8} and genitalia as in Fig. 21A–C. T₄ with an admixture of yellowish, whitish or pinkish-orange hairs, T_{5–7} with ferruginous hairs ... *P. (Fernaldaepsithyrus) quadricolor* Lepeletier p. 23
- St₆ as in Figs. 23A, 24A. St_{7–8} and genitalia as in Figs. 22–24. T_{4–5} otherwise coloured 8
8. A₃ markedly shorter than A₅. A_{6–13} 2× their width. Genal furrow distinct. St_{7–8} and genitalia as in Fig. 22A–E *P. (Fernaldaepsithyrus) norvegicus* Sp. Schneider p. 36
- A₃ hardly or not shorter than A₅. A_{6–13} shorter than

- 2× their width. Genal furrow indistinct. St₇₋₈ and genitalia as in Figs. 23–24 9
9. Scapus sparsely haired. Hind tibia and Bt with longest hairs in black posterior fringes about 1.5× their greatest width. Extreme distal margin of St₆ more or less bilobed (Fig. 23A). St₇₋₈ and genitalia as in Fig. 23B–E. T₄ with whitish hairs
 ... *P. (Fernaldaepsithyrus) sylvestris* Lepeletier p. 25
- Scapus densely haired. Hind tibia and Bt with longest hairs in ferruginous posterior fringes about 2× their greatest width. Distal margin of St₆ oval (Fig. 24A), occasionally truncate. St₇₋₈ and genitalia as in Fig. 24B–E. T₄ with yellow hairs
 ... *P. (Fernaldaepsithyrus) flavidus* (Eversmann) p. 28

Psithyrus (Ashtonipsithyrus) bohemicus (Seidl)

Figs. 6, 16, 25.

Bombus bohemicus Seidl, 1837:73, No. 19. Type locality: Czechoslovakia: Praha. Type lost (Tkalců 1969).

Apis nemorum Fabricius, 1775:380, No. 8; Zimsen 1964:415, No. 1075. Type locality: Copenhagen ("Hafniae"), type ♀ BCL.

Bombus aestivalis Dahlbom, 1832:51 nec Panzer 1801. *Psithyrus aestivalis*: Siebke 1866.

Psithyrus vestalis auctt. nec Geoffroy in Fourcroy 1785; Kriechbaumer 1854; Wahlberg 1855b; Lie-Pettersen 1901, 1902, 1905, 1907; Strand 1901; Friese 1902; Aurivillius 1903; Bengtsson 1904, 1931; Muchardt 1904; Sp. Schneider 1909, 1918; Jansson 1925; Fridén et al. 1962; Hasselrot 1962.

Apathus vestalis auctt., nec Geoffroy in Fourcroy 1785; Thomson 1870, 1872; Siebke 1880; Sp. Schneider 1898; Strand 1898b. *Psithyrus bohemicus* (Seidl); Meidell 1934; Jansson 1935; Brinck 1951; Kruseman 1959; Ander 1963, 1965; Kullenberg et al. 1970, 1973; Kullenberg 1973; Bringer 1973; Peters 1974; Svensson 1974, 1980.

Psithyrus distinctus Pérez, 1884:268. Type locality: The Pyrenees. Lectotype ♀ MNPI; Brinck & Wingstrand 1949.

Taxonomical remarks

The type specimen of *Apis nemorum* synonymized with *vestalis* by Smith (1844, 1876) is an *Ash-tonipsithyrus* but the individual is too seriously damaged to be identified to species (Yarrow in litt.). *P. vestalis* (Geoffroy in Fourcroy) has previously repeatedly been confused with *P. bohemicus*. As *P. vestalis* is not known from the type area of *A. nemorum* where *P. bohemicus* is common, *A. nemorum* may refer to the latter.

P. vestalis var. *amoenus* Schmiedeknecht, 1883 as mentioned by Sp. Schneider (1909) is an infrasubspecific form. A few named colour variations (ex. coll. Sp. Schneider TRM!) are unpublished infrasubspecific forms.

First Scandinavian records

Norway. MRy: Ørskog (Siebke 1866), no voucher specimen traced. HES: Odalen, HOy: Bergen, NSi: Saltdalen (Siebke 1880).

Sweden. SK, SM, VG, Lapland (Dahlbom 1832).

Subgenus *Ashtonipsithyrus* Frison

Ashtonipsithyrus Frison, 1927:69, type-species *Apathus ashtoni* Cresson, 1864, by original designation.

Description

FEMALE

Head. Malar space shorter than $\frac{2}{3}$ the distal width, about as long as A₄₊₅. Main keel of mandible poorly developed (Fig. 6A). Labral furrow deep, well defined. Labral tubercles slightly or not raised, angled at inner end, distally pointed; distal distance between them at least $\frac{1}{3}$ labral width. Or = 2× Oe or just longer.

Hind leg. Bt at most 2.5× longer than its greatest width, markedly broader basad than distad, almost as wide as adjoining part of tibia.

Gaster. Tip of gaster not much incurved. St₆ with ridge-like callosities (Figs. 6C, 7B).

MALE

Head. Malar space shorter than $\frac{2}{3}$ the distal width.

Hind leg. Bt about 3.5× longer than its greatest width.

Genitalia. As in Figs. 16C, 17B; penis valve not hooked beneath.

Scandinavian species

Two European species, viz. *P. bohemicus* and *P. vestalis*, both of which occur in Scandinavia.

*Description**FEMALE*

Body of medium size. Coat rather shaggy.

Measurements: N=20. Rl: 4.06 ± 0.265 mm, 3.55–4.45 mm; Iw: 4.79 ± 0.316 mm, 4.20–5.30 mm; Hw: 4.55 ± 0.233 mm, 4.15–4.90 mm; hamuli number: 20.75 ± 1.410 , 18–23; Lh: 1.63 ± 0.102 mm, 1.45–1.78 mm; Dh: 0.083 ± 0.004 mm, 0.078–0.094 mm.

Head. Malar space with close distribution of fine punctures admixed with some coarser ones, distally fading into an almost impunctate, large subtriangular area. Clypeus more sparsely and coarsely punctate on disc than at base, distally with a well defined median impunctate space. Upper gena with sparse to moderate distribution of punctures of varying size; genal furrow usually indistinct. OOb without accumulation of minute punctures (Fig. 6B). $A_3:A_4:A_5 = 19.5:11:14$, A_{6-12} just longer than their distal width.

Hind leg. Bt about $2\times$ longer than its greatest width. Longest hairs in posterior fringe of tibia and Bt as least as long as the segment's greatest width.

Gaster. T_6 smooth, shiny, nearly impunctate on the disc, closely punctured laterad and distad. Ridge-like callosities (Fig. 6C) distally more pointed and less separated than in *P. vestalis* (Fig. 7B); rather sparse – mainly fine – punctures on the disc between the callosities.

Colour pattern. Broad, pale to dull yellow collar extending about $1/4$ down the adjacent episternum and more or less projecting backwards below base of wing. Extreme posterior fringe of scutellum usually with single yellow hairs concealed by black ones. Sparse pale yellow or whitish hairs in lateral patches of T_1 . Latero-posterial patches and extreme distal margin of T_3 , T_4 , and lateral patches of T_5 whitish-haired. T_6 laterally and distally, and St_6 outside and between callosities clothed with golden-brown pubescence. Otherwise coat black. Yellow hairs paler than in *P. vestalis*.

Variation. Pile of vertex encroached by yellow. Collar varying in width, reduced to lateral patches or completely replaced by black hairs. Pile in crescent-shaped posterior fringe of scutellum ranging from all black to nearly all yellow. Slight variation in the amount of whitish hairs on T_3 and T_5 . Whitish hairs, particularly on T_3 occasionally replaced by yellow ones.

MALE

Body of medium size. Coat shaggy, long.

Measurements. N = 20. Rl: 3.62 ± 0.200 mm, 3.05–3.85 mm; Iw: 3.62 ± 0.195 mm, 3.25–3.90 mm; Hw: 4.13 ± 0.204 mm, 3.60–4.40 mm; hamuli number: 17.15 ± 0.988 , 16–19; Lh: 1.32 ± 0.079 mm, 1.18–1.48 mm; Dh: 0.082 ± 0.006 mm, 0.072–0.093 mm.

Head. Malar space markedly longer than A_5 , distally impunctate or nearly so, otherwise with irregularly spaced minute punctures admixed with some coarser ones. Upper gena with irregularly spaced, shallow punctures of varying size; genal furrow usually distinct. Or = $2\times$ Oe or nearly so. OOb without accumulation of minute punctures (see Fig. 6B). $A_3:A_4:A_5 = 17:10.5:16$, A_{6-13} about $1.5\times$ their distal width; flagellum about $3\times$ longer than scapus.

Hind leg. Tibia with a small almost hairless area close to distal margin; longest hairs in posterior fringe up to $1.5\times$ the segment's greatest width. Bt $3.5\times$ longer than its greatest width or nearly so; longest hairs in posterior fringe up to $2\times$ Bt's greatest width.

Gaster. St_{7-8} and genitalia as in Fig. 16A–C; that part of volsella visible from above about $1.5\times$ longer than gonostylus.

Colour pattern. Pile of vertex with black and yellow intermixed. Collar laterally extending about $1/4$ down episternum, hairs of posterior fringe of scutellum and T_1 yellow. Hairs of latero-posterial patches of T_3 , T_{4-5} , lateral patches of T_6 , at least fringes of St_{4-5} whitish. Otherwise coat black.

Variation. Pile of vertex ranges from all black to predominant yellow. Yellow collar varying in width, laterally passing more than half way down episternum, reduced to lateral patches or turning all black. Pile of scutellum ranging from all yellow to all black. Pile of particularly mid and hind basitarsi occasionally pale yellowish-brown or tipped so. Whitish patches of T_3 varying in size, occasionally whitish hairs extending along extreme distal margin. White hairs on T_3 replaced by yellow ones. Pile on T_5 admixed with black hairs on the disc. Pile on St_{2-5} ranging from all black to all whitish.

Melanism. Colour variations are too slight to change the general colour pattern except for sporadically occurring pronounced melanic specimens. The darkest individuals are nearly black, having at most whitish hairs on T_5 . The tendency

towards melanism is slightly more pronounced in southernmost Sweden (SK, ÖL) than further north.

Host

Bombus lucorum (L.) (Sladen 1912; Cumber 1949; Pouvreau 1973).

Flight season

SE Norway: Hibernated female: 14 May – 11 August; female progeny: ? – 29 September; male: 24 June – 29 September.

Distribution

Scandinavia (Fig. 25). Occurring throughout the peninsula to nearly 70°N; the northernmost records examined are from Norway: Try: Tromsø and TRi: Nordreisa: Sappen. Recorded from sea level to the treeline and occasionally observed up to 1000 m a.s.l. in *regio subalpina*. Locally rather common except along the peripher coast from SW Norway and northwards.

A total of about 850 Norwegian and 1870 Swedish specimens were examined. Unrevised records (Fig. 25) refer to Meidell (1934 and unpublished notes) and Ander (in litt.).

World distribution. Eurosiberian. Occurring from western Europe (incl. the British Isles and the Mediterranean islands) and Turkey east to the Pacific Ocean.

An occurrence in Morrokko (Blüthgen 1918) is questioned as voucher specimens were not traced (Koch, MNB in litt.) and *Bombus lucorum* is so far not observed south of Europe. Morrocco is, however, poorly investigated. The distribution of *P. bohemicus* is otherwise within the range of *B. lucorum* (Løken 1973).

Psithyrus (Ashtonipsithyrus) vestalis (Geoffroy in Fourcroy)

Figs. 7, 17.

Apis vestalis Geoffroy in Fourcroy, 1785:450, No. 27. Type locality: France: Paris. Type not traced.

Psithyrus vestalis (Geoffroy in Fourcroy); Hasselrot 1960; Løken 1978.

Bremus aestivalis Panzer, 1802–05, Part 89, Tab. 16. Type not traced.

Taxonomical remarks

A female (Sweden: SK: Lund) captured 25 May 1953 when forcing her way into a nest of *Bombus terrestris* (L.) (Hasselrot 1960) might belong to *P. vestalis*. The author confused, however, this inquiline with *P. bohemicus* (Hasselrot 1962) and the actual individual is not traced. Scandinavian records otherwise published before 1978 as *P. vestalis* apply to *P. bohemicus*, cf. references to this species.

First Scandinavian record

Sweden: SK: Lund (?Hasselrot 1960, cf. above; Løken 1978).

Description

FEMALE (description based on the only Scandinavian specimen which is identified with certainty)

Body large. Coat even.

Measurements. N = 1. Rl: 4.55 mm; Iw: 5.20 mm; Hw: 5.00 mm; hamuli number: 22; Lh: 1.875 mm; Dh: 0.089 mm.

Head. Malar space with irregular, coarse punctures bordering the uniform fine puncturing at the base; large distal area almost impunctate. Upper gena with moderate distribution of mainly coarse, distinct punctures; genal furrow absent. OOb with accumulation of minute punctures (Fig. 7A). A₃:A₄:A₅ = 18:10.5:16, A_{6–12} just longer than their distal width.

Hind leg. Bt nearly 2.5× its greatest width, longest hairs in posterior fringe about 0.5× this width; those of tibia about 3/4 the greatest width of the segment.

Gaster. T₆ moderately punctured on the disc. Callosities of St₆ (Fig. 7B) distally less pointed, more separated than in *P. bohemicus* (Fig. 6C); coarsely punctured on the disc between the callosities.

Colour pattern. Broad dark yellow collar laterally just covering adjacent margin of episternum. T₃ with large, dull yellow lateral patches, distally shading into whitish hairs fringing entire distal margin. Hairs of T_{4–5} whitish. T₆ laterally and distally and St₆ outside and between callosities clothed with golden-brown pubescence. Otherwise coat black.

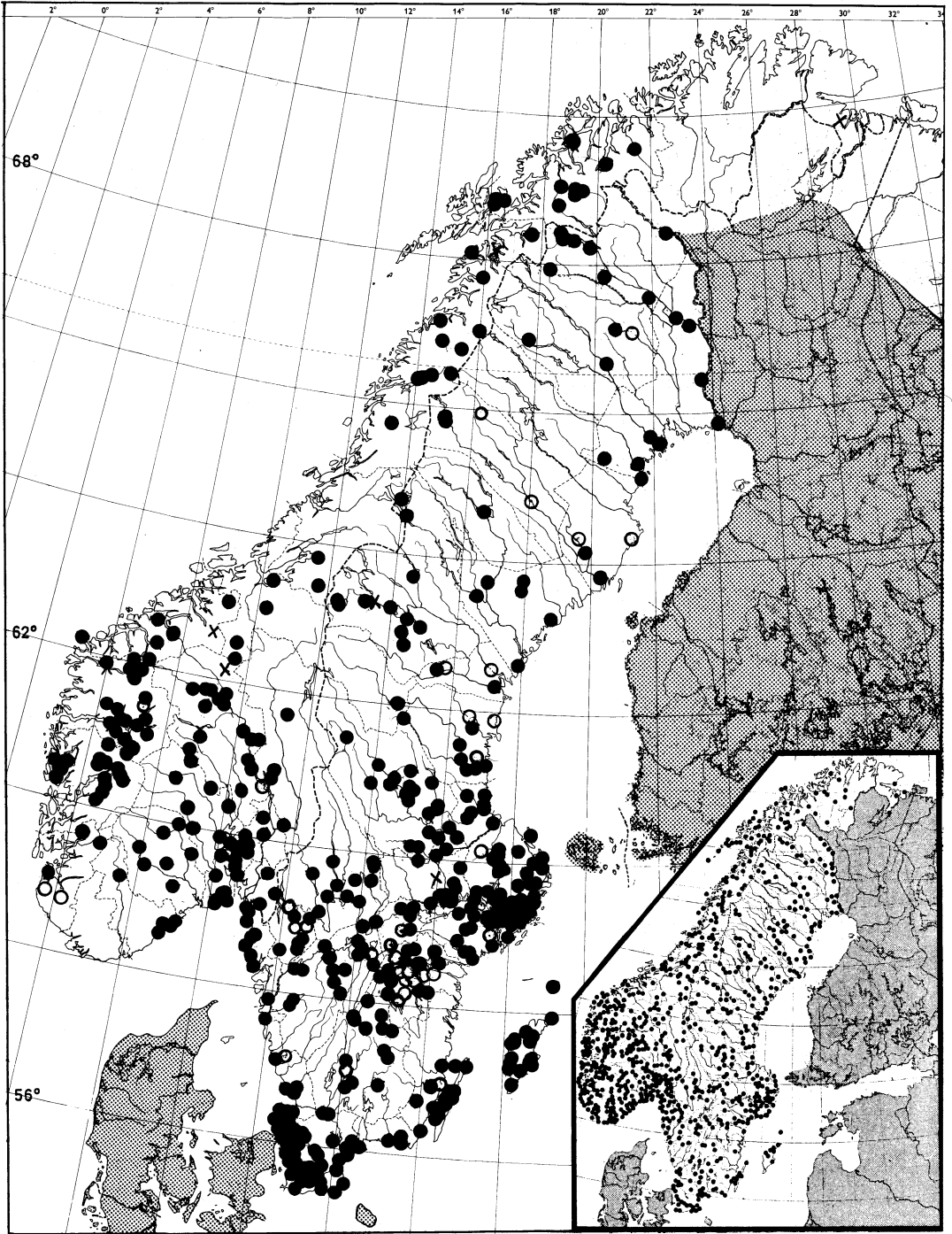


Fig. 25. *P. bohemicus* (Seidl). The distribution in Fennoscandia and Denmark, Inset: The host *B. lucorum* (L.) (Løken 1973) updated 1983. ● = one or several localities; ○ = unrevised records (from literature or received in litt.); X = inaccurate locality. Shaded areas refer to literature indications.

MALE (description based on Central European specimens)

Head. Malar space slightly longer than A_5 . Genal furrow absent. Or barely exceeding $2 \times Oe$. OOb with slight accumulation of minute punctures. $A_3:A_4:A_5 = 15.5:10.5:20$, A_{6-13} longer than $1.5 \times$ their distal width; flagellum about $3.5 \times$ longer than scapus.

Hind leg. Tibia distally with no evident hair-less area outside; longest hairs in posterior fringe barely or not exceeding the segment's greatest width. Bt at least $3.5 \times$ longer than its greatest width; longest hairs of posterior fringe not longer than this width.

Gaster. St_8 and genitalia as in Fig. 17A–B; that part of volsella visible from above about as long as gonostylus.

Colour pattern. Pile of vertex black, slightly encroached by yellow. Collar laterally extending $1/4$ down episternum, single hairs on T_1 and T_3 (except anterior lunate part) sulphurous-yellow. Hairs of T_{4-5} , T_6 (except posterior lunate part), fringes of St_{3-5} whitish. Otherwise coat black.

Host

Bombus terrestris (L.) (Sladen 1912; ?Hasselrot 1960:122; Pouvreau 1973; Van Honk et al. 1981).

Distribution

Scandinavia. So far observed only in the nemoral zone in southernmost Sweden (SK: Lund) which is the northernmost record of the species. Rare.

World distribution. Euromediterranean. Western Europe (incl. the British Isles and the Mediterranean islands) north to Germany, Poland, Sweden (Prov. of Skåne/Scania) – Central European USSR – Algeria – Turkey – the Caucasus – northern Iran.

The distribution of the inquiline is within that of its host, *B. terrestris* (Løken 1973).

Subgenus *Allopsithyrus*

Subgenus *Allopsithyrus* Popov, 1931:136. Type-species *Apis barbutella* Kirby, 1802. Original designation.

The subgenus is represented by two European

species, viz. *P. maxillosus* (Klug) and *P. barbutellus* (Kirby) of which only the latter is distributed north to Fennoscandia.

Psithyrus (*Allopsithyrus*) *barbutellus* (Kirby)

Figs. 9, 18, 26.

Apis barbutella Kirby, 1802:343, No. 93. Type locality: England: E. Suffolk, Barham. Lectotype ♀ KCL! Yarow (1968).

Psithyrus barbutellus (Kirby): Aurivillius 1903; Erlandsson 1960; Fridén et al. 1962; Ander 1963, 1965; Kullenberg et al. 1970, 1973.

Apis saltuum Panzer, 1800–1801, part 75, Tab. 21. Type not traced.

Bombus saltuum: Dahlbom 1832.

Psithyrus saltuum: Kriechbaumer 1854; Wahlberg 1855b.

Apathus campestris: Thomson nec Panzer, 1800–1801; Thomson 1872.

Nomenclatural and taxonomical remarks

The records treated by Siebke (1870, 1873, 1880) as *P. saltuum* or *P. campestris* = *P. saltuum* and referred to by Strand (1898b) were doubtless misidentified. The determinations refer to *P. barbutellus*, a species not otherwise recorded in Norway. Siebke (1880) and Sp. Schneider (1918) followed Thomson (1872) who erroneously synonymized Dahlbom's *B. saltuum* with *P. campestris* (Panzer), a species occurring in Norway but not observed in the SE lowlands where Siebke had collected. Sp. Schneider (1918) questioned Siebke's determinations but searched in vain for the actual specimens; I have not been able to locate them either.

First Scandinavian records

Sweden: SK, SM, VG (Dahlbom 1832).

Description

FEMALE

Body of medium size. Coat rather shaggy.

Measurements. $N = 14$. $RI: 4.18 \pm 0.203$ mm, $3.75\text{--}4.45$ mm; $Iw: 4.87 \pm 0.250$ mm, $4.40\text{--}5.20$ mm; $Hw: 4.95 \pm 0.174$ mm, $4.60\text{--}5.20$ mm; hamuli number: 21 ± 1.240 , $19\text{--}23$; $Lh: 1.63 \pm 0.112$ mm,

1.40–1.78 mm; Dh: 0.082 ± 0.004 mm, $0.075\text{--}0.087$ mm.

Head. Malar space about $\frac{3}{4}$ the distal width, about as long as A_{3+4} ; integument more or less striate-rugose closely set with punctures of varying size fading into an almost impunctate narrow area close to distal margin. Main keel of mandible well developed, anteriorly tapering, reaching margin or almost so. Labral furrow deep, broad; labral tubercles protuberant, blunt, the distal distance between them at least $\frac{1}{3}$ labral width. Clypeus more sparsely and markedly more coarsely punctate on disc than at base. Upper gena with rather dense, distinct, mainly coarse punctation; genal furrow absent or indistinct. Or about $2 \times$ Oe. $A_3:A_4:A_5 = 19:11:16$, A_{6-12} as long as their distal width.

Hind leg. Bt markedly narrower than adjoining tibia, about $3 \times$ longer than its greatest width. Longest hairs in posterior fringe of tibia and Bt equal to the segment's greatest width or just longer.

Gaster. Tip of gaster not much incurved. T_{4-5} with rather close, mainly coarse puncturing. T_6 with close, rather uniform, mainly medium-sized punctation; usually with a weak, narrow impunctate, median longitudinal keel. St_6 with flattened semi-circular callosities positioned at a distance from apex (Fig. 9).

Colour pattern. Pile of vertex with an admixture of yellow. Hairs of collar just passing margin of episternum, scutellum and variable part of T_1 yellow. Hairs of T_4 and lateral patches of T_5 whitish. T_6 and St_6 outside the callosities with golden-brown pubescence. Otherwise coat black.

Variation. Pile of vertex ranging from predominantly yellow to all black. Yellow collar more or less reduced. Pile of scutellum ranging from all yellow to all black except a few yellow hairs along extreme posterior margin. Legs with variable admixture of pale-coloured hairs, especially in the fringes.

MALE

Body of medium size. Coat rather shaggy.

Measurements. N = 20. RI: 3.44 ± 0.178 mm, $3.25\text{--}3.75$ mm; Iw: 3.62 ± 0.241 mm, $3.20\text{--}4.05$ mm; Hw: 4.25 ± 0.163 mm, $3.90\text{--}4.50$ mm; hamuli number: 18.60 ± 1.698 , 17–23; Lh: 1.30 ± 0.059 mm, $1.20\text{--}1.44$ mm; Dh: 0.074 ± 0.007 mm, $0.059\text{--}0.083$ mm.

Head. Malar space hardly as long as distal width, as long as A_{3+4} ; integument distally impunctate or almost so, otherwise irregularly punctured, punctures coarser centrally than basad. Upper gena with rather dense mainly shallow, coarse punctation; genal furrow absent, occasionally indistinct. Or about $2 \times$ Oe. Hairs of scapus about $2 \times$ width of segment; $A_3:A_4:A_5 = 16:10.5:19$, A_{6-13} nearly $2 \times$ their distal width; flagellum about $3 \times$ longer than scapus.

Hind leg. Bt $3.75 \times$ longer than its greatest width. Tibia and Bt with longest hairs in posterior fringe hardly or not exceeding their greatest width.

Gaster. St_6 with 2 mounded callosities. St_{7-8} and genitalia as in Fig. 18A–C; penis valve hooked beneath.

Colour pattern. Pile of vertex, collar just passing margin of episternum, scutellum and T_1 yellow. Hairs of extreme distal margin of T_3 , T_{4-5} , lateral patches of T_6 , St_{2-5} whitish. Otherwise coat black.

Variation. Pile of vertex with variable admixture of black. Yellow collar extending $\frac{1}{4}$ to $\frac{1}{2}$ down episternum. Yellow hairs of scutellum more or less reduced to crescent-shaped posterior fringe.

Melanism

Both sexes display a slight tendency towards melanism which is more pronounced in southernmost Sweden (SK, ÖL) than further north.

Host

Bombus hortorum (L.) (Ball 1914; Cumber 1949; Müller 1936; Postner 1952). *B. hypnorum* (L.) (Pouvreau 1973).

Host species mentioned by Hoffer (1889) are omitted as the author confused *P. barbutellus* and *P. sylvestris*. *P. barbutellus* observed established in a colony of *B. pratorum* (L.) and *B. ruderarius* respectively (Pouvreau 1973) are a misprint (Pouvreau in litt.).

Flight season

Southern Sweden: Hibernated female: 9 May – 2 August; female progeny: ? – 3 September; male: 1 July – 5 October.

Distribution

Scandinavia (Fig. 26). Restricted to Sweden where it is widely distributed in nemoral and boreonemoral zones northeast to about 60°N. Single records north to 61° (DR: Mora) indicate a scattered distribution in the southern boreal zone. Rather scarce. A total of about 485 specimens were examined.

List of localities: Sweden: SK: Alnarp TCL ZML, Bjärred, Björnstorp, Bonderup ZMB ZML, Bulltofta, Bökeberg, Båstad NRS, Dalby NRS ZMB ZML, Degeberga, Fjälkinge, Fågelsång, Gunnarstorp NRS, Harlösa ZMA, Helsingborg ZMA ZML, Hyby, Häckeberga, Iltorp, Kivik NRS, Kävlinge, Kristianstad NRS, Kullaberg, Lomma, Lund NRS ZMA ZMB ZML ZMU, Löderup NRS, Marsvinsholm NRS, Malmö, Norra Ugglarp, Nosaby, Ormanäs, Pålshöj ZMA, Reslöv, Räften in Lund DCL ZML, Sandhammaren, Silvåkra, Simrishamn NRS, Skarhult, Skegrie, Södra Åsum ZMB, Sösdala, Torup, Tosterup NRS, Vittemölla NRS, Vomb, Väsby, Ystad NRS ZML, Övedskloster. – BL: Sölvesborg ZMA. – HA: Dagsås GNM, Varberg. – SM: Brånstorp NRS, Gränna GNM ZML, Kalmar NRS, Ljungby, Oskarshamn. – ÖL: Algutsrum CBJS, Borgholm NRS ZML, Ekerum ZMB, Hornsjön NRS, Högsrum-Rälla GNM ZML, Mörbylånga NRS, Persnäs alvar, Resmo NRS, Runsten, Torslunda CBJS, Vickleby NRS ZML. – ÖG: Bjärke, Bohyttan ZMB, Borensberg GNM ZML ZMU, Källstad ZMU, Linköping, Norrköping ZMA ZMU, Skeda, Slaka W Linköping, Skänninge, Stjärntorp ZMB, Vadstena. – VG: Falköping NRS, Skövde GNM ZML. – DS: Köpmannebro, Rostock ZMB, Mellerud. – NÄ: Arboga, Bärsta NRS, Stora Mellösa ZMB, Örebro NRS. – SÖ: Brandalsund NRS, Nacka, Nyköping NRS, Oxelösund NRS, Valla NRS, Ålberga ZMB. – UP: Grimo NRS, Harpabol NRS, Häggeby NRS, Rö NRS, Stockholm GNM, Uppsala CBJS NRS ZMA ZML, Vassunda NRS, Österskär. – VM: Munktorp NRS. – VR: Åros. – DR: Harnäs NRS, Ludvika NRS ZML, Mora CBJS. – GÄ: Björke NRS, Gävle.

Unrevised records: (Ander in litt.): SK: Arrie TCL, Lackalånga DCL, Norra Grönby SE Malmö, Ringsjön DCL TCL, Rösjöholm DCL, Röstånga DCL, Saxtorp, Svedala, Trelleborg, Törringelund E Malmö TCL. – ÖG: Alvastra, Breviksnäs, Hovetorp, Fredensborg, Motala DCL, Omberg, Ravnäs E Norrköping, Svanshals by lake Tåkern. – DS: Kroppefjäll. – SÖ: Hölö.

World distribution. Eurosiberian. Western Europe (excl. the Mediterranean islands) – European USSR north to about 62°N – Turkey – The Caucasus – Siberia – Mongolia.

The distribution of the inquiline is within that of the host, *Bombus hortorum* (Løken 1973).

Subgenus Psithyrus (s.str.) Lepeletier

Psithyrus Lepeletier, 1832:372–374. Proposed as a

genus. Type-species *Apis rupestris* Fabricius, 1793 by designation of Curtis 1833:468.

Uneigentlichen Hummeln Illiger, 1806.

Bombus divisio 2:da Dahlbom, 1832:31, 51.

Apathus Newman, 1835:404. Type-species *Apis rupestris* Fabricius. Autobasic.

Psithyrus (s.str.) rupestris (Fabricius)

Figs. 8, 19, 27.

Apis rupestris Fabricius, 1793:320, No. 26; Zimsen 1964:416, No. 1087. Type locality: Germany. Lecto-type ♀ KCC! (Løken 1966a).

Bombus rupestris (Fabricius); Dahlbom 1832; Zetterstedt 1838.

Psithyrus rupestris (Fabricius); Dahlbom 1837; Kriechbaumer 1854; Wahlberg 1855b; Siebke 1866; Lie-Pettersen 1901, 1907; Aurivillius 1903; Wahlgren 1915, 1917; Sp. Schneider 1918; Meidell 1934; Erlandsson 1960; Fridén et al. 1962; Hasselrot 1962; Ander 1963, 1965; Kullenberg et al. 1970, 1973; Kullenberg 1973; Bringer 1973; Cederberg 1979, 1983.

Apathus rupestris (Fabricius); Thomson 1870, 1872; Siebke 1880; Nerén 1892; Strand 1898a,b.

Apis arenaria Panzer, 1800–1801, part 74, Tab. 12. Type not traced.

Apis frutetorum Panzer, 1800–1801, part 75, Tab. 20. Type not traced.

Apis albinella Kirby, 1802:361. Type locality: England: E. Suffolk, Barham. Holotype ♂ KCL! (Yarrow 1968).

Bombus obscurus Seidl, 1837:68, No. 7. Type not traced.

First Scandinavian records

Norway: Oslo (Siebke 1880). Records from MRy: Ørskog (Siebke 1866) could not be traced and must be due to misidentifications or confusion of labels. The area, situated almost 62°30'N and 6°40'E, is outside the known distribution of the species and of the host species as well (Fig. 27).

Sweden: SK, SM, ÖG, VG, UP (Dahlbom 1832).

*Description**FEMALE*

Body large. Coat even, short.

Measurements. N = 20. RI: 4.78 ± 0.243 mm, 4.40–5.30 mm; Iw: 5.60 ± 0.334 mm, 5.10–6.10 mm; Hw: 5.47 ± 0.245 mm, 5.10–6.00; hamuli number: 22.60 ± 1.667 , 19–25; Lh: 1.79 ± 0.079 mm, 1.65–1.93 mm; Dh: 0.083 ± 0.006 mm, 0.075–0.093 mm.

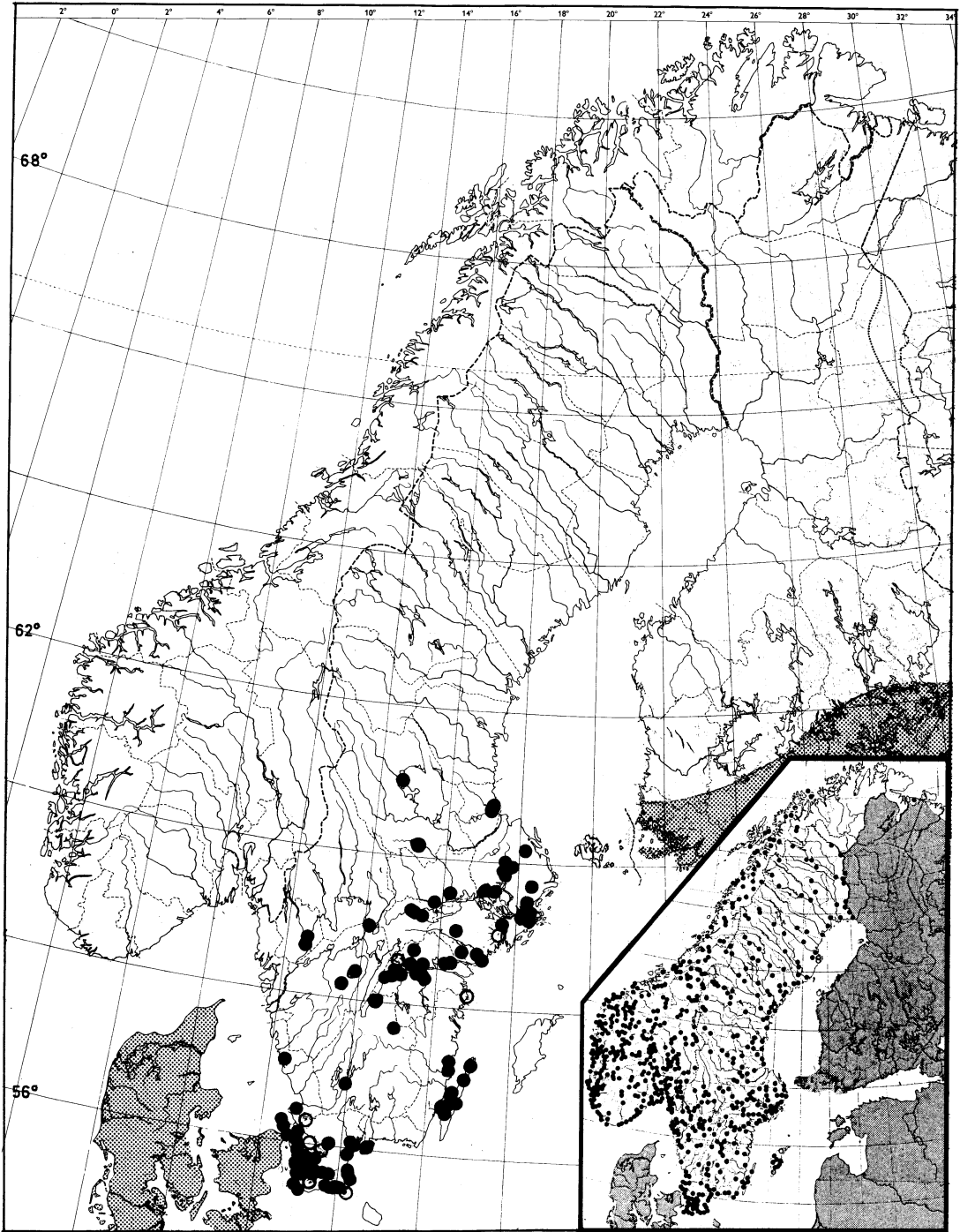


Fig. 26. *P. barbutellus* (Kirby). Inset: The host *B. hortorum* (L.) updated 1983. Legend as in Fig. 25.

Head. Malar space slightly shorter than its distal width, about as long as A_{3+4} ; integument smooth with rather close distribution of punctures of varying size, distally almost impunctate. Main keel of mandible well developed, reaching margin, occasionally tapering distally or broadly truncated close to margin. Labral furrow deep, more or less widened towards the base; labral tubercles distally pointed, feebly raised, the distal distance between them less than $\frac{1}{3}$ labral width. Clypeus with irregular, close, mainly coarse punctures except for a small impunctate space close to distal margin. Upper gena with sparse, mainly coarse punctation; genal furrow absent, occasionally indistinct. Or about $2 \times$ Oe. $A_3:A_4:A_5 = 21:13:16$, A_{6-12} each as long as wide.

Wing. Brownish-black, opaque or almost so.

Hind leg. Bt markedly narrower than adjoining part of tibia, almost parallel-sided, exceeding $3.5 \times$ its width. Tibia and Bt with longest hairs in posterior fringe rarely exceeding the segment's greatest width.

Gaster. Tip of gaster not much incurved. T_{4-5} alutaceous with rather close, coarse punctation. T_6 strongly chagreened with close mainly medium punctures. Callosities of St_6 produced into strong triangular flanges visible from above (Fig. 8).

Colour pattern. Pile on T_{4-5} , sparse lateral hairs on T_6 and distal fringe of St_5 reddish. T_6 and St_6 outside and between callosities clothed with ferruginous pubescence. Otherwise coat black.

Variation. Specimens with indication of yellow or whitish collar may occur; a single individual with pronounced, narrow yellow collar reaching episternum was examined. T_4 occasionally with anterior lunate part black-haired.

MALE

Body small. Coat somewhat shaggy.

Measurements. N = 20. Rl: 3.47 ± 0.188 mm, $3.05-3.85$ mm; Iw: 3.53 ± 0.198 mm, $3.15-4.00$ mm; Hw: 4.14 ± 0.147 mm, $3.80-4.40$ mm; hamuli number: 18.25 ± 1.209 , 17-21; Lh: 1.31 ± 0.078 mm, 1.18-1.45 mm; Dh: 0.076 ± 0.006 mm, 0.064-0.086 mm.

Head. Malar space about as long as distal width, as long as A_{3+4} or almost so; integument smooth or alutaceous, usually finer and closer punctured basad than laterad and distad. Upper gena with sparse to moderate distribution of mainly coarse punctures; genal furrow indistinct, occasionally

distinct or absent. Or about $1.5 \times$ Oe. Scapus densely haired. $A_3:A_4:A_5 = 15.5:10.5:17$, A_{6-13} about $1.5 \times$ their width, flagellum about $3.3 \times$ longer than scapus.

Hind leg. Tibia with longest hairs in posterior fringe about $1.5 \times$ its greatest width. Bt parallel-sided about $4.5 \times$ longer than wide, longest hairs in posterior fringe at least $2 \times$ Bt's width.

Gaster. St_6 flattened with latero-posterial tufts of long hairs. St_{7-8} and genitalia as in Fig. 19A-C; penis valve hooked beneath.

Colour pattern. Narrow collar laterally just reaching episternum, distal fringe of scutellum and a variable part of T_1 yellowish-grey to whitish. Pile of T_{4-7} , St_{4-6} and posterior fringes of all basitarsi ferruginous to reddish. Fringes of all tibiae pale ferruginous. Otherwise coat black.

Variation. Hairs of thorax and T_1 black, T_{2-3} with small latero-posterial patches of yellowish-grey hairs. Pile of anterior lunate part of T_4 and fringes of all legs black.

Host

Bombus lapidarius (L.) (e.g. Dahlbom 1837; Hoffer 1889; Sladen 1899, 1912; Cumber 1949; Pouvreau 1973; Alford 1975). The inquiline has also been observed usurping nests of *B. sylvarum* (L.) (Höppner 1901; May 1959), *B. sicheli alticola* Kriechbaumer (Bullman 1953; Móczár 1977), *B. pascuorum* (Scopoli) (Haeseler 1970). It is uncertain, however, whether records of two *B. pratorum* colonies each containing a female *P. rupestris* refer to accidental visits of the inquiline or is an early stage of usurpation (Van Honk et al. 1981).

Flight season

Southern Sweden: Hibernated female: 1 May - 2 August; female progeny: ? - 18 October; male: 10 July - 2 October.

Distribution

Scandinavia (Fig. 27). Confined to nemoral and boreonemoral zones and locally penetrating the northern boreal zone in Norway and the southern boreal zone in Sweden. Widespread in the lowlands of SE Norway and throughout Sweden NE

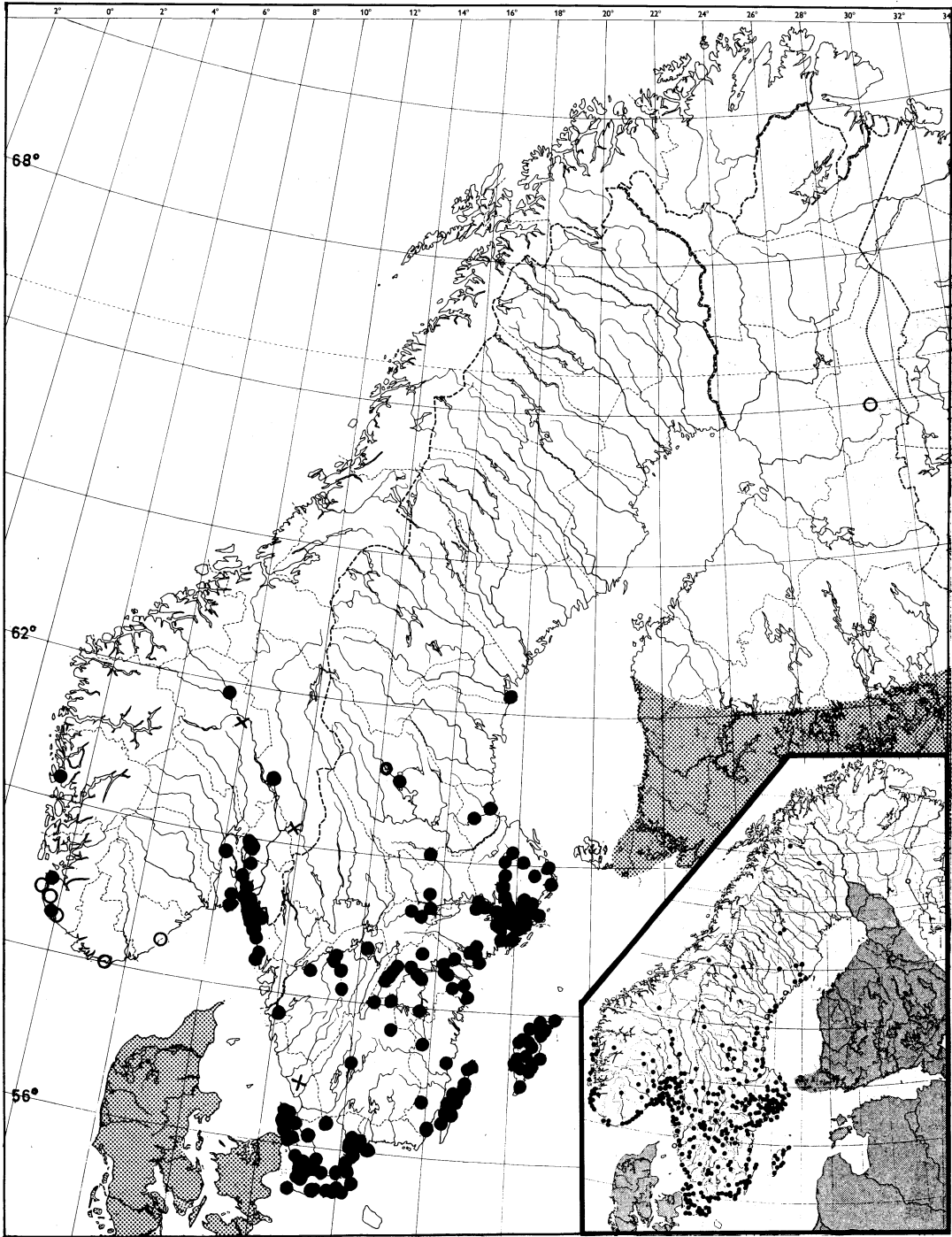


Fig. 27. *P. rupestris* (Fabricius). Inset: The host *B. lapidarius* (L.), updated 1983. Legend as in Fig. 25.

to about 62°N. It is uncertain whether the population along the western coast of Norway still exists as the inquiline has not been observed the last 50 years (cf. the list below).

Scarce except in cultivated or urban areas where *B. lapidarius* locally is the dominant *Bombus* species.

A total of about 125 Norwegian and 1200 Swedish specimens were examined.

List of localities. Norway. Ø: Hvaler: Herføl, Kirkøy, Søndre Sandøy; Kråkerøy: Kråkerøy; Onsøy: Rørvik; Råde: Fuglevik; Moss: Jeløy ZMA, Moss ZMA. – Ak: Ås: Vollebekk; Bærum: Ullern. – Oslo: BML SJAN TRM ZMA ZMB ZML ZMO. – HES: Odalen: Sør-Odal ZMO; Hamar: SORN. – On: Fron: ZMO; Sel: Laugard ZMO. – Bø: Ringerike: ZMO; Drammen. – VE: Nøtterøy: Teie; Tjøme: Mo-stranda. – Ry: Ognå: Ognå 3♀ 14.VII.1931 and Stavanger: Madla ♀ VII. 1931 Meidell leg. ZMB. – HOy: Bergen: Skipanes ♂ 10.VII.1907 Barca leg. ex coll. Vogt ZMA.

Unrevised records: AAY: Arendal and VAY: Mandal (Meidell unpubl.). Ry: Klepp and HOy: Bergen: Tveiterås (Lie-Pettersen 1901, 1907). HOy: Bergen (Sp. Schneider 1918).

Correction: A male AAY: Tvedestrand: Stensøy 4.IX.1897 (Strand 1898a) was revised to *P. campestris*.

Sweden. SK: Alnarp, Andrarum, Arkelstorp NRS, Balsby, Bara ZMB ZML, Barkåkra NRS, Bonderup ZMB, Brunnby NNW Helsingborg, Brösarp, Bökeberg, Dalby ZMB, Falsterbo NRS ZML. Fjälkinge, Fågel-sång, Helsingborg ZMA ZML, Hovs Hallar NRS, Ivö, Klostersågen, Kullaberg, Lackalänga, Lund GNM ZMA ZMB ZML, Löderup NRS, Malmö NRS ZMA ZML, Mälarhusen NRS, Mölle, Nosaby, Reslöv, Råby, Sandhamaren NRS ZML, Saxtorp, Simrishamn NRS, Skarhult NRS, Skivarp, Strandbaden 45 km NNW Helsingborg, Södra Sandby ZMB, Torekov, Torna-Hällestad, Torup E Malmö, Trelleborg GNM, Vitaby, Vitemölla, Vittsjö NRS, Vittskövle NRS, Vomb E Lund, Ystad NRS ZML, Åhus NRS. – BL: Hällevik. – HA: Dagsås GNM, Karup. – SM: Bergkvara NRS, Brånstorp NW Eksjö NRS, Gränna GNM NRS ZML ZMU, Hultsfred, Nybro NRS, Oskarshamn, Tranås NRS, Värnamo NRS. – ÖL: Algutsrum CBJS, Bengtstorp, Borgholm NRS ZML, Byrum NRS ZMB, Bjärby alvar, Bödastrand ZMB, Ekerum ZMB, Eriksöre NRS, Färjestaden, Glömminge, Gärdslösa NRS ZML, Gårdby CBJS ZMB, Halltorp, Högberg ZMU, Högby, Högsrum NRS ZML, Kastlösa NRS ZML, Köping, Löt, Mörbylånga NRS ZML, Persnäs alvar, Resmo, Rong, Rälla NRS, Råpplinge NRS ZML, Skogsby NRS, Solliden, Torslunda CBJS, Vickelby NRS ZMB ZML. – GO: Ardre, Boge Burs, Eksta, Etelhem, Furdume NRS ZML, Fride, Fröjel, Fårö NRS ZML, Garda, Guldrupe, Höglint, Hörnsne ZMB, Kappelhamn NRS, Klinte, Kullej NRS, Ljugarn ZMA ZML, Lojsta, Lye, Lärbro NRS ZML, Snäckgärdet NRS, Stånga, Visby NRS ZML, Våmblingbo NRS ZML ZMU. – ÖG: Alvastra SW Motala NRS, Borensberg GNM ZML ZMU, Borsjön NRS, Gryt, Harg NRS, Hällestad NRS, Linköping NRS ZMB ZML, Motala NRS, Norrköping SNBS ZMA, Ömberg NRS ZMA, Ringarum NRS, S:t Anna NRS,

Skönberga NRS, Svanshals 45 km SE Linköping ZMA, Söderköping ZMB, Vretakloster ZMB, Väderstad, Väversunda NRS. – VG: Falköping NRS, Grästorp NRS, Händene by Skara NRS, Partille NRS, Råbäck NRS, Töreboda NRS ZML, Österplana NRS. – BO: Bovallstrand NRS, Grebbestad NRS, Havstensund NRS, Naverstad NRS, Strömstad NRS ZML, Sydskoster SW Strömstad NRS, Uleberghamn NRS. – NÄ: Arboga, Björnäs NW Arboga NRS, Latorp SNBS, Stora Mellösa ZMB, Örebro NRS. – SÖ: Botkyrka NRS, Brandalsund NRS, Helgarö N Strängnäs, Larslund NRS, Mörkö NRS, Nyköping NRS, Oxelsund NRS, Runtuna NRS, Strängnäs ZMB, Tosterön NE Strängnäs, Tullgarn NRS, Tyresö NRS, Viksberg NRS, Västerhaninge ZMB. – UP: Adelsö NRS, Andersby NE Uppsala SNBS, Dalby SNBS, Djurö, Ekerö NRS, Erken SNBS, Fresta 90 km NNW Stockholm NRS, Höllö LHAS, Hågeby N Uppsala NRS, Hässelby NE Uppsala SNBS, Håbo-Tibble NW Stockholm NRS, Håtuna S Sigtuna NRS, Lennartnäs NRS, Lovön NRS, Rådmansö NRS, Skokloster ZMB, Stockholm NRS ONNS ZMA ZMB, Stocksund NRS, Ultuna, Uppsala NRS ONNS SNBS ZMA ZML. Vaddö ZMB, Älvkarleby CBJS, Österskär. – DR: Mora CBJS, Söderbärke NRS. – GÄ: Björke N Gävle, Hille-Forsby. – ME: Myrbodarna SE Sundsvall ♂ 11.IX.1974 L.Å. Janzon leg. NRS.

World distribution. Eurosiberian. Western Europe (excl. the Mediterranean islands except Sicilia) – European USSR (north to the timber line) – Turkey – the Caucasus – Siberia – Mongolia – Northern Manchuria.

The distribution of the species is in Europe, Turkey and the Caucasus within that of the west palaearctic *B. (Melanobombus) lapidarius* and further east within the distribution of *B. (Melanobombus) sicheli* Radoszkowski (Reinig 1935; Thalcü 1974b).

Subgenus *Metapsithyrus* Popov

Subgenus *Metapsithyrus* Popov, 1931:135. Type species *Apis campestris* Panzer, 1800–1801. Original designation.

Psithyrus (Metapsithyrus) campestris (Panzer)

Figs. 10, 20, 28.

Apis campestris Panzer, 1800–1801, part 74, Tab. 11. Type locality: Germany. Type not traced.

Bombus campestris (Panzer); Dahlbom 1832.

Psithyrus campestris (Panzer); Wahlberg 1855a,b; Lie-Pettersen 1902, 1905, 1907; Aurivillius 1903; Sp. Schneider 1918; Meidell 1934; Fridén et al. 1962; Ander 1963, 1965; Kullenberg et al. 1970; Kullenberg 1973; Bringer 1973.

Apis rosiella Kirby, 1802:331, No. 85. Type locality: England: E. Suffolk: Barham. Lectotype ♂ KCL! (Yarrow 1968).

Bombus rosiellus (Kirby); Dahlbom 1832.

Apathus rosiellus (Kirby); Thomson 1870, 1872.

Apis leana Kirby, 1802:333, No. 86. Type locality: England: E. Suffolk: Barham. Holotype ♂ KCL! (Yarrow 1968).

Apis francisana Kirby, 1802:334, No. 87. Type locality: England: E. Suffolk: Barham. Holotype ♂ KCL! (Yarrow 1968).

Nomenclatural and taxonomical remarks

Wahlberg (1855b) argued that the description of *P. campestris* by Dahlbom (1832) applied to *campestris* Panzer while the appurtenant figure may refer to the male of *P. svaveolens* Wahlberg = *P. quadricolor* Lepeletier. The figure is in my opinion too diffuse for a specific division of Dahlbom's *campestris* which should be confined to that of Panzer only.

First Scandinavian records

Norway: HOy: Bergen (Lie-Pettersen 1902).

Sweden: SK, SM, VG (Dahlbom 1832). Records from Lapland (Dahlbom 1832) were revised to *P. flavidus* (Thomson 1872).

Description

FEMALE

Body of medium size. Coat rather even, gaster markedly sparser coated than in the remaining European species.

Measurements. Norway (AAy-HOy): N = 20. Rl: 3.94 ± 0.159 mm, 3.50–4.20 mm; Iw: 4.82 ± 0.261 mm, 4.45–5.15 mm; Hw: 4.64 ± 0.166 mm, 4.15–4.90 mm; hamuli number: 22.25 ± 1.916 , 18–26; Lh: 1.57 ± 0.090 mm, 1.40–1.70 mm; Dh: 0.074 ± 0.004 mm, 0.067–0.082 mm.

Head. Malar space nearly as long as distal width, slightly shorter than A_{3+4} ; integument smooth with irregular distribution of punctures of varying size distally fading into a well defined minutely punctured area. Main keel of mandible usually broad, reaching about $2/3$ down to margin, broadly abrupted distad. Labral furrow deep, broad, widened towards the base; labral tubercles distally pointed, feebly raised, the distal distance

between them exceeding $1/3$ labral width. Clypeus with dense, coarse punctation except for a median impunctate area close to distal margin. Upper gena with scattered minute punctures between mainly shallow coarse ones; genal furrow absent, occasionally inconspicuous. Or shorter than $2 \times$ Oe. $A_3:A_4:A_5 = 17.5:10.5:15$, A_{6-12} hardly longer than their distal width.

Hind leg. Tibia with longest hairs in posterior fringe slightly or not longer than its greatest width. Bt markedly narrower than adjoining part of tibia, hardly $3 \times$ longer than its greatest width, longest hairs in posterior fringe hardly exceeding $0.5 \times$ its width.

Gaster. Tip of gaster not much incurved. T_{4-6} shiny; closer, finer punctured medially than laterad and distad. Terminal of St_6 slightly produced; the callosities convex distally pointed, almost reaching apex and separated by a narrow, deep furrow (Fig. 10).

Colour pattern. Pile of vertex with slight admixture of yellow. Hairs of broad collar, extending about $1/4$ down episternum, scutellum, latero-posterior patches of T_3 and large patches of T_{4-5} yellow. Interlar-band laterally with varying admixture of yellow hairs, posteriorly more or less V-shaped. T_6 and St_6 with pale yellow to golden-brown pubescence. Yellow pile on thorax usually paler than that of gaster. Otherwise coat black.

Variation. Pile of vertex all black. Pile on collar, scutellum individually ranging from all black to all yellow, rarely hairs on thorax all yellow except for a few black hairs on the disc. Yellow hairs on gaster more or less replaced by black ones. Completely melanic specimens occur.

MALE

Body of medium size. Coat shaggy.

Measurements. Norway (AAy-HOy): N = 20. Rl: 3.48 ± 0.162 mm, 3.20–3.80 mm; Iw: 3.64 ± 0.244 mm, 3.25–4.10 mm; Hw: 4.11 ± 0.121 mm, 3.90–4.30 mm; hamuli number: 19.85 ± 1.226 , 18–22; Lh: 1.42 ± 0.069 mm, 1.30–1.50 mm; Dh: 0.075 ± 0.004 mm, 0.069–0.083 mm.

Head. Malar space hardly shorter than distal width, as long as A_{3+4} or almost so; integument feebly alutaceous with irregular distribution of mainly minute to moderate punctures distally fading into a fine-punctured or impunctate area.

Upper gena with irregular mainly distinct, coarse punctation; genal furrow absent, occasionally indistinct. Or shorter than $2\times$ Oe. $A_3:A_4:A_5 = 15.5:11:20$, $A_{6-13} 2\times$ their width; flagellum about $3.5\times$ longer than scapus.

Hind leg. Tibia with longest hairs in posterior fringe slightly exceeding its greatest width. Bt $3.75 - 4\times$ longer than its greatest width, longest hairs in posterior fringe rarely reaching this width.

Gaster. St_6 distally flattened or feebly, rather evenly callose; latero-posteriorly with prominent erect tuft of long hairs. St_{7-8} and genitalia as in Fig. 20A–C; penis valve hooked beneath.

Colour pattern. Pile of vertex, collar extending $1/4 - 1/2$ down episternum and scutellum pale to lemon-yellow; distal half of T_3 , T_{4+5} and lateral patches on T_6 sulphurous-yellow. St_{2-5} with yellowish-white fringes. Otherwise coat black.

Variation. Pile of vertex ranging from all black to all yellow. Yellow collar more or less reduced. Interlar-band laterally with a variable admixture of yellow hairs. Pile on scutellum ranging from all yellow to all black. T_1 with admixture of yellow or whitish hairs, rarely all hairs yellow or whitish. T_2 with small latero-posterial yellow patches occasionally coaliscised along distal margin. Pile on T_{3-6} ranging from all black to all sulphurous-yellow. Fringes of sternites more or less darkened by admixture of black hairs. Completely melanic specimens not rare although some dark yellow or brownish hairs often encroach lateral patches of T_{4-5} .

Melanism

The unstable colour pattern in the Scandinavian *P. campestris* characterized by the tendency to melanism shows no obvious geographical variation. Slight to complete melanic females and males occur everywhere throughout the distributional area.

Host

Bombus pascuorum (Scopoli) (Hoffer 1889; Cumber 1949; Pouvreau 1973; Alford 1975). The inquiline has also been observed usurping colonies of *B. humilis* Illiger (Hoffer 1889), *B. pomorum* (Panzer) (May 1937) and *B. pratorum* (Pouvreau 1973).

Flight season

Southern Sweden: Hibernating female: 22 May – 1 August; female progeny: ? – 19 September; male: 3 July – 4 October.

Distribution

Scandinavia (Fig. 28). Confined to the nemoral and boreonemoral zones, locally penetrating into the southern boreal zone in Sweden.

The species is in Norway occurring in sheltered, luxuriant biotopes along the southern and western coast from outer Oslofjord to about $62^\circ N$. A single record further north (STi: Trondheim) may indicate a continuous but scattered coastal distribution north to about $63^\circ 30' N$. The absence of the species in the fairly well investigated southeastern lowlands (Ø, AK) is noteworthy considering the wide inland distribution of the species in Central Sweden and the range of the main host *B. pascuorum* (Fig. 28).

Rather scarce. A total of about 170 Norwegian and 550 Swedish specimens were examined.

List of localities. Norway. Ø: Moss ♀ 25. VII. 1910 Barca leg. ZMA. – VE: Ramnes: Kjær; Andebu: Kodal; Stokke: Langø; Nøtterøy: Teie; Larvik: Yttersø SJAN. – TEy: Drangedal: Omnes. – AAY: Tvedestrand: Nes Verk TRM ZMB ZMO, Stensøy ZMO; Moland: Noje; Hisøy: TRM; Grimstad: Dømmesmoen; Landvik: Hørte. – VAY: Kristiansand: Randesund ZMO; Søgne: Søgne; Lindesnes: Ramsland; Kvinesdal: S. Kvinesdal. VAI: Hægebostad: Eie. – Ry: Lund: Moi; Bjerkreim: Ivesdal; Sokndal: Åmot; Klepp: Klepp; Time: Mossige; Gjesdal: Nese; Sandnes: Brattebø, Ims; Stavanger: Lindøy. Ri: Forsand: Meling; Suldal: Jelsa, Saudasjøen, Slettedalen. – HOy: Os: Lyse Kloster, Moldegård; Bergen: Appeltunvann, Arna, Bergen TRM ZMB, Dolvik ZMA, Eidsvågssjell, Fantoft, Korsnes, Leitet, Skipanes, Skjold, Starefoss, Steinestø; Askøy: Davanger, Herdla; Osterøy: Kleppe. Hoi: Kvinnherad: Gjermundnes, Lio, Ljosmyr, Rosendal, Varaldsøy. – SFy: Hyllestad: Eide. SFi: Vik: Koprekstad Kirke; Aurland: Aurlandsvangen; Lærdal TRM; Sogndal: Slinde, Åberget; Balestrand: Flesje. – MRy: Vanylven: Thue ♀ 18. VII. 1957 Løken leg. – STi: Trondheim ♀ 3. VII. 1954 Lørvik leg.

Unrevised records: VAY: Mandal and Ry: Strand: Tau (Meidell 1934).

Corrections. Records from Oslo, HEn: Åmot and Bø: Ringerike (Siebke 1873, 1880; Strand 1898b) are due to nomenclatural confusion and misidentification as well (cf. p. 12).

Sweden. SK: Andrarum, Billebjer ZMB ZML, Björnstorp, Blentarp NRS, Brunneby, Brösarp, Bärlöv ZMB, Bökeberg, Dalby ZMB ZML, Eslöv ZMB, Fjelling, Hallands Väderö, Helsingborg ZMA ZML, Håc-

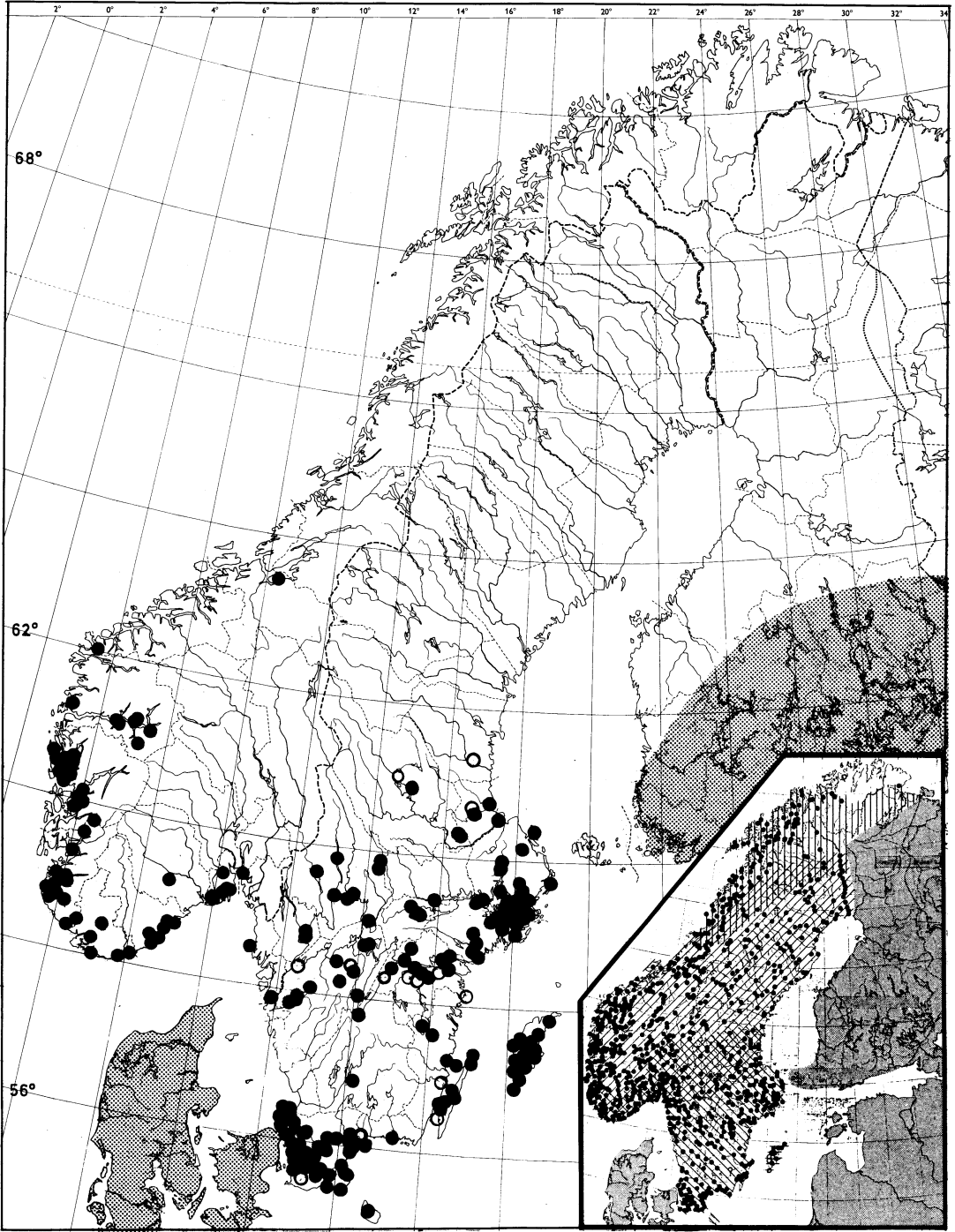


Fig. 28. *P. campestris* (Panzer). Inset: The host *P. pascuorum* (Scopoli) updated 1983. The hatching refers to the distribution of subspecies. Legend as in Fig. 25.

keberga, Hässleholm, Höör, Immeln, Kivik, Klostersången, Klöva, Kullaberg, Kyrkheddinge, Källstorp, Linderöd, Ljungbyhed ZMB, Lomma, Lund ZMB ZML, Malmö, Norra Ugglarp, Nosaby, Nytorp, Osbyholm, Ravlunda ZMB ZML, Sandhammaren NRS, Skarhult, Skärallid, Torna-Hällestad, Torup, Vallåkra, Vanås, Vasatorp, Vitemölla, Vomb, Vram, Västra Karup, Vånga, Ystad NRS, Åhus, Ängelholm, Örtofta, Övedskloster. – BL: Ronneby, Torsö. – SM: Blå Jungfrun, Jönköping NRS, Kalmar NRS, Kalmarsund NRS, Oskarshamn, Ryssby ZMU, Södra Vi GNM, Tuna, Österkorsberga ZML ZMU. – ÖL: Borgholm ZMA, Böda NRS, Ekerum ZMB, Färjestaden, Grankullaviken, Gärdslösa NRS, Köping ZMB, Råpplinge, Torslunda CBJS, Vickleby. – GO: Ardre, Boge, Burs, Fardume NRS, Fide, Fröjel, Färösund, Garda, Hemse, Höglint, Klintehamn, Lojsta, Slite, Stånga, Visby NRS ZML, Västerhejde NRS. – ÖG: Borensberg GNM ZML ZMU, Borsjön NRS, Linköping ZMB ZML, Norrköping SNBS ZMA, Söderköping ZMB, Tjällmo ZMB, Vadstena, Vreta Kloster ZMB, Värna. – VG: Alingsås ZMU, Alvasjö NRS, Falköping NRS, Höjentorp NRS, Mjörn ZML, Skara GNM, Skövde NRS ZMU, Västra Bodarna ZML ZMU, Vårgårda ZMU. – BO: Ytterby NRS. – DS: Rostock NRS ZMB, Skällered NRS. – NÄ: Arboga, Bjärsta NRS, Rinkaby NRS, Stora Mellösa ZMB. – SÖ: Botkyrka NRS, Brandalsund NRS, Helgarö, Mörkö NRS, Nyköping NRS, Oxelösund NRS, Runtuna NRS, Stjärnhov NRS, Svärdsö NRS, Södertälje, Tyresö NRS, Västerhaninge ZMB. – UP: Brudnäs NRS, Dalby S Uppsala SNBS, Ekerö NRS, Fresta NRS, Frösunda NRS, Gimo NRS, Gräsö NRS, Hågeby NRS, Håbo-Tibble NRS, Ingarö, Lennartnäs NRS, Lovö NRS, Mälardalshöjden NRS, Närtuna NRS, Norrviken NRS, Rådmansö NRS, Stockholm ZMU, Uppsala NRS SNBS ZML, Vind NRS, Älvkarleby CBJS, Österskär, Österåker NRS. – VÄ: Arvika, Björknäs NRS, Grums NRS, Gylleby NRS, Horrsjön NRS, Långban NRS, Tynäs NRS, Årås. – DR: Horndal CBJS, Mora CBJS, Vikarbyn NRS. – GÄ: Hille NRS.

Unrevised records (Ander in litt.). SK: Härlöv, Läckalänga, Kävlinge. – BL: Gammaltorp. – SM: Ramsås by Ålem. – ÖL: Västerstad. – ÖG: Björkhult, Bredviksnäs, Gårdeby, Munkebo, Omberg. – VG: Hunneberg, Sparresäter NW Skövde. – GÄ: Högbö. HÄ: Ringsjö.

World distribution. Eurosiberian. Western Europe (excl. the Mediterranean islands) – European USSR north to about 60°N – Turkey – N Iran – the Caucasus – Southern Siberia – Mongolia – Northern China – Manchuria.

The distribution of the species is within that of the main host, *B. pascuorum* (Løken 1973).

Subgenus *Fernaldaepsithyrus* Frison

Subgenus *Fernaldaepsithyrus* Frison, 1927:70. Type-species *Psithyrus fernaldae* Franklin, 1911 by original designation.

Description

FEMALE

Head. Malar space as long as distal width or slightly shorter. Labral furrow shallow; labral tubercles not prominent, distally blunted, the distal distance between them usually exceeding $\frac{1}{3}$ labral width. Or shorter than $2 \times$ Oe.

Hind leg. Bt markedly narrower than adjoining part of tibia, about $3 \times$ longer than its greatest width, posteriorly feebly curved.

Gaster. Tip of gaster strongly incurved (Fig. 15). Extreme terminal part of St_6 reaching further than T_6 and hooked; visible from above as a triangle distally produced into a sharp point; callosities of St_6 small, narrow, convergent (Figs. 11–14).

MALE

Head. Or shorter than $2 \times$ Oe. Flagellum about $3 \times$ longer than scapus.

Hind leg. Bt $3.75 - 4 \times$ longer than its greatest width.

Gaster. St_{7-8} and genitalia as in Figs. 21–24; volsella beyond gonostylus almost parallel-sided, more than $2 \times$ longer than wide, ending in a hair-tuft; penis valve hooked beneath.

Scandinavian species

The subgenus is in Scandinavia represented by all the species occurring in Europe, viz. *P. quadricolor* Lepeletier, *P. sylvestris* Lepeletier, *P. flavidus* (Eversmann) and *P. norvegicus* Sp. Schneider.

Taxonomical remarks

Fernaldaepsithyrus constitutes a well defined subgenus. The close relationships between the species, however, caused much early confusion which was mainly clarified by Richards (1928) and Popov (1931).

The females are distinguished by several sclerotic features in addition to details in the colour of the coat.

The males are likewise recognized by qualitative characters described below, but the great variability in the structural features, several of which

overlap between the species, occasionally impede reliable identification of European specimens. An exception is *P. quadricolor* where the variability in the diagnostic characters interferes in a lesser degree with the remaining species, e.g. it is recognized by the shape of St_6 and details in the colour pattern (cf. below). Reliable determination of critical males of *P. sylvestris*, *P. flavidus* and *P. norvegicus* is, however, obtained by using the classification functions derived from a step-wise discriminant analysis routine based on morphometric variables (Løken & Framstad 1983). In that paper, however, there are some few errors: Page 48 column 2: K/E everywhere to be read N/E. E (527.56870) column *P. sylvestris* read 527.32467. Table I: I(7.138) column *P. flavidus* read 1.738. Page 49 column 1: E(167.99313) column *P. norvegicus* read 167.88313.

***Psithyrus (Fernaldaepsithyrus) quadricolor* Lepeletier**

Figs. 14, 21, 29.

Psithyrus quadricolor var. *quadricolor* Lepeletier de Saint Fargeau 1832:376, 1841:428. Type locality: The Pyrenees. Type not traced.

Psithyrus quadricolor Lepeletier; Richards 1928.

Apathus quadricolor (Lepeletier); Thomson 1870 (partim).

Bombus frutetorum: Zetterstedt nec Panzer 1801, the ♂.

Psithyrus globosus Eversmann, 1852. Type locality: USSR: Orenburg, Spaskoje. Type (holotype) ♀ MAL!; Lie Pettersen 1901, 1905, 1907; Muchardt 1904; Aurivillius 1903; Strand 1904; Sp. Schneider 1918; Ander 1965; Kullenberg et al. 1970; Bringer 1973.

Apathus globosus (Eversmann); Thomson 1872; Siebke 1880; Strand 1898b.

Psithyrus quadricolor globosus Eversmann; Richards 1928; Meidell 1934; Ander 1963.

Psithyrus syaveolens Wahlberg 1855a:232. Type locality: Sweden: Östergötland. Lectotype ♀ ZML! (Ander 1967); Wahlberg 1855b.

Psithyrus quadricolor var. *intercalaris* Müller, 1913.

Psithyrus meridionalis Richards, 1928:351. Type locality: Yugoslavia: Styria. Lectotype ♀ TRM!, hereby designated (cf. below).

Psithyrus quadricolor meridionalis Richards; Tkalc̃ 1962.

Taxonomical remarks

P. quadricolor is divided into 5 subspecies in Europe, viz. *P. q. quadricolor*, *P. q. arvernensis* Richards, *P. q. globosus* Eversmann, *P. q. rossicus* Popov and *P. q. meridionalis* Richards. The

designations refer to variations in the colour pattern of the coat and were based on a few specimens (Richards 1928; Popov 1931). *P. q. meridionalis* is well defined (cf. below). The subspecific status of the remaining taxa is questionable (Tkalc̃ 1962). I find, however, it is most adequate to retain the subspecific divisions above until further material from populations throughout the range of this species is studied.

***P. quadricolor meridionalis* Richards**

P. globosus auctt., nec Eversmann.

Designation of lectotype

P. meridionalis was described from a ♀ and 12 ♂♂ of which the ♀ and one of the ♂♂ are in coll. TRM. The ♀ is hereby designated as lectotype and has the following labels: (1) "Styria, Tragop Ober"; (2) "E. Graeffe"; (3) *Ps. meridionalis* n.sp. ♀ type" [handwritten]; (4) "lectotype *P. meridionalis* Richards ♀ design. A. Løken 1984". The specimen is in good condition except that left A_{7-12} , 3 last tarsal segments of the right hind leg and 2 last tarsal segments of the left hind leg are lost. Colour pattern: Pile on more than posterior $0.5\times$ of T_3 , T_{4-5} and fringes of St_{2-5} ferruginous. Coat otherwise black.

A male paralectotype designated as allolectotype has labels as follows: (1–2) As for the lectotype; (3) "*Ps. meridionalis* ♂ type" [handwritten]; (4) "allolectotype *P. meridionalis* Richards ♂ design. A. Løken 1984". The specimen is in good condition except that the 2 last tarsal segments of the left hind leg are lost. The sculpture agrees with that of *P. quadricolor*. Colour pattern: Pile on posterior half of T_3 , T_{4-7} , single hairs in fringes of mid leg, most hairs in posterior fringe of hind tibia and Bt , and fringes of sternites ferruginous. Coat otherwise black.

***Psithyrus quadricolor globosus* Eversmann**

Fig. 29.

First Scandinavian records

Norway: On: Dovre, SFi: Jostedal (Wahlberg 1855b).

Sweden: Localities not mentioned (Kriech-

baumer 1854). ÖG, VG and Stockholm (Wahlberg 1855b).

Description

FEMALE

Body of medium size. Coat rather shaggy.

Measurements. Norwegian west coast. N = 20. RI: 3.93 ± 0.101 mm, 3.70–4.10 mm; Iw: 4.67 ± 0.245 mm, 4.20–5.00 mm; Hw: 4.56 ± 0.144 mm, 4.30–4.80 mm; hamuli number: 21.37 ± 1.557 , 17–24; Lh: 1.56 ± 0.124 mm, 1.28–1.73 mm; Dh: 0.077 ± 0.005 mm, 0.069–0.088 mm.

Head. Malar space as long as A_{3+4} or nearly so; surface rather smooth with a mixture of mainly minute and medium-sized punctures distally fading into a more or less triangular, finer punctated area; occasionally impunctate close to distal margin. Main keel of mandible well developed, reaching more than $2/3$ to distal margin, anteriorly broadly truncate or acute. Upper gena with closely set minute and coarse punctures; genal furrow indistinct. Scapus dull, with dense decumbent hairs. $A_3:A_4:A_5 = 17.5:11.5:15$, A_{6-12} slightly longer than their width.

Hind leg. Tibia with longest hairs in posterior fringe up to $1.5\times$ its greatest width. Bt's longest hairs at least as long as its greatest width.

Gaster. T_5 markedly more sparsely punctured than T_3 . T_6 almost impunctate on the disc, usually with inconspicuous, median longitudinal keel continuing into a more or less pronounced depression towards apex. Narrow callosities of St_6 feebly convex (Fig. 14).

Colour pattern. Broad yellow collar laterally just covering adjacent edge of episternum. Hairs on T_{3-5} ferruginous. Fringes of at least St_{4-5} pale to bright ferruginous. T_6 , St_6 outside and between callosities clothed with ferruginous to golden-brown pubescence. Coat otherwise black.

Variation. Lateral patches on T_1 admixed with a few yellow hairs. Hairs of lunate anterior part of T_3 black. Ferruginous hairs especially on T_{3-4} more or less replaced by greyish-white hairs.

MALE

Body large. Coat shaggy.

Measurements. Norwegian western coast. N = 20. RI: 3.60 ± 0.148 mm, 3.40–3.85 mm; Iw: 3.76

± 0.228 mm, 3.35–4.05 mm; Hw: 4.35 ± 0.151 mm, 4.00–4.50 mm; hamuli number: 18.70 ± 1.559 , 16–21; Lh: 1.41 ± 0.100 mm, 1.25–1.55 mm; Dh: 0.080 ± 0.006 mm, 0.069–0.091 mm.

Head. Malar space as long as its distal width or nearly so, shorter than A_{3+4} ; integument smooth, occasionally striate with rather sparse minute and medium-sized punctures distally fading into a more finely punctate or impunctate area of varying size. Upper gena with close, mainly distinct, coarse punctures; genal furrow distinct, occasionally indistinct. Scapus more or less chagreened, densely haired. $A_3:A_4:A_5 = 17:12.5:19$, A_{6-13} nearly $2\times$ their distal width.

Hind leg. Tibia and Bt with longest hairs in posterior fringe about $1.5\times$ their greatest width.

Gaster. St_6 distally broadly rounded, the margin feebly, evenly elevated. St_{7-8} and genitalia as in Fig. 21A–C; basal inner extension of gonocoxite slightly elongate (cf. Fig. 23D); gonostylus rather evenly punctate, dull, inner margin more or less concave.

Colour pattern. Pile of vertex, collar laterally just passing margin of episternum, distal fringe of scutellum and main part of T_1 yellow. Hairs of T_3 distad and laterad and T_4 more often yellowish-white or pinkish-orange than ferruginous; hairs of T_{5-7} ferruginous. Hairs of at least St_{3-6} pale ferruginous. Fringes of mid and hind basitarsi brownish to ferruginous. Otherwise coat black.

Variation. Pile of vertex, scutellum and T_1 ranging from all yellow to all black. Yellow collar varying in width, continuing way down episternum. Interlar band laterally admixed with yellow hairs. T_2 laterally with some yellow hairs concealed by black ones. Pile of T_3 ranging from all black to all yellowish-white or greyish-white or just fringed so. Ferruginous pile on T_4 darker shaded on disc than laterad. T_5 with single black hairs on basal part of the disc, T_{6-7} with small whitish patches laterad.

Host

Bombus soroensis (Fabricius). *P. q. meridionalis* has been found established in colonies of the red-tailed *B. s. proteus* Gerstäcker and the paler coloured *P. q. globosus* in a colony of the white-tailed *B. s. soroensis* (Hoffer 1889; Skorikov 1922). This difference in host/inquiline relationship coincides with the general distribution of

subspecies of host and parasite, respectively (cf. below).

P. quadricolor usurping a colony of *B. pratorum* (L.) (Pouvreau 1973) is a misprint (Pouvreau in litt.). *B. ruderarius* (Müller) listed as a host (Pekkarinen et al. 1981) refers to an observation by A. Nordman of a ♀ flying into a nest of this *Bombus* sp. (Pekkarinen in litt.).

Flight season

Southern Sweden: Hibernating female: 4 May – 12 August; female progeny: ? – 13 September; male: 9 June – 9 October.

Distribution

Scandinavia (Fig. 29). Confined to nemoral and boreonemoral zones. In Sweden also occurring in the southern boreal zone.

In Norway more often observed at sea level in luxuriant biotopes along the western coast than in the southeastern lowlands. In Sweden widely distributed north to "limes norrlandicus" (NU 1977) and further north occasionally recorded together with *B. soroensis* throughout the southern boreal zone. A single record in central boreal zone (VB: Degerfors NRS) indicates a scattered distribution northeast to at least about 64°N.

Scarce. A total of 135 Norwegian and about 230 Swedish specimens were examined.

List of localities. Norway. Ø: Moss: Jeløy ZMA. – Oslo: ZMO. – On: Vestre Slidre: Valdres ZMO; Dovre: Dovrefjell ♂ Boheman leg. 1832 NRS. – TEi: Lunde: Vommestøl. – AAy: Tvedestrand: Nes Verk TRM. AAi: Bygland: Austad ZMO. – Ry: Strand: Tau; Fister: Fister; Tysvær: Nedstrand. Ri: Forsand: Lerang; Årdal: Eskeland, Årdal; Hjelmeland; Suldal: Åimjødlo by Mostøl 700 m. – HOy: Bergen: ZMB TRM, Dolvik ZMA, Fantoft, Hop, Minde, Sanddalen, Skipanes ZMA. HOi: Ullensvang: Djonno, Utne; Ulvik: Hjeltnes. – SFy: Gloppen: Lotsberg. SFi: Stryn, Flo. – MRy: Ørskog: Skjodje ZMO. MRI: Norddal: Valldal.

Unrevised records: SFi: Luster: Jostedalen (Wahlberg 1855b). HOy: Askøy, islands in Feieffjord and HOi: Voss (Lie Pettersen 1901, 1905). Ry: Eigersund: Heskestad, Ri: Suldal: Jelsa, HOi: Odda and SFi: Balestrand: Balholm (Meidell 1934).

Correction. A female from VAY: Kristiansand: Randesund ZMO (Richards 1928) is revised to *P. campestris*.

Sweden. SK: Andrarum, Brösarp, Helsingborg, Häckeberga, Jordholmen ESE Malmö ZMA, Klostersågen, Kåseberga NRS, Lund, Nytorp, Sandhammaren NRS, Torekov, Torna-Hällestad, Vallåker, Vitemölla, Vomb,

Västra Vram, Övedskloster. – HA: Halmstad NRS, Hässlöv, Snöstorp NRS. – SM: Fågelfors. Gränaberget, Höreda NRS, Korsberga, Markaryd, Ryssby, Sjötorp by Alvesta, Västervik, Österkorsberga GNM ZML. – ÖL: Bengtstorp, Borgholm, Böda NRS ZMU, Gärdslösa, Högrum-Rälla, Röd, Vickleby. – ÖG: Borsjön NRS, Brunneby GNM ZML, Linköping, Vadsena. – VG: Gråstorp NRS, Töreboda NRS. – NÅ: Arboga, Örebro NRS. – SÖ: Larslund NRS, Norrköping NRS ZMA, Nyköping NRS, Runtuna NRS, Trosa, Tuna NRS, Tyresö. – UP: Häverö NRS, Ingarö, Nacka, Stockholm, Uppsala. – VR: Alster NRS, Arvika, Eda, Forsvik SE Säffle, Grums NRS, Årås. – DR: Brunnsvik NRS, Ludvika NRS, Mora NRS, Oxberg NRS. – GÅ: Ockelbo NRS. – HÅ: Delsbo. – VB: Degerfors S Vindeln ♂ 26.VIII.1935 Forsslund leg. NRS.

Correction. A record for this species in Lapland (Friese 1902, referring to Wahlberg 1855b) is incorrect and due to linguistic misunderstanding.

The total distribution of the subspecies P. quadricolor globosus Eversmann. Fennoscandia – Denmark – The Baltic – European USSR.

Sparse information about the Danish population (Hammer 1970; a few dark coloured specimens examined by me) indicate that the subspecies may intergrade with *P. q. meridionalis* in Denmark; in SE Europe it intergrades with *P. q. rossicus* (Popov 1931).

World distribution of P. quadricolor Lepeletier. In Europe restricted to mountain islets in Spain, the Pyrenees, France, northern Italy, the Alps, northern Balkans and Slovakia; north of the Alps widely distributed north to Fennoscandia and to about 62° in European USSR. Discontinuously occurring from Turkey NE to Transbaykal.

The present information about distribution of the species indicates a division into two geographically segregated groups similar to that of the host *B. soroensis* (Løken 1973). *P. q. meridionalis* occurs within the range of the red-tailed *B. s. proteus* (Richards 1928; Tkalců 1969; Reinig 1973) and the islet distribution of the remaining subspecies is within the distribution of the white-tailed *B. s. soroensis*.

Psithyrus (Fernaldaepsithyrus) sylvestris Lepeletier

Figs. 11, 23, 30.

Psithyrus quadricolor var. *sylvestris* Lepeletier de St. Fargeau, 1832:377, 1841:429. Type locality: Described on specimens from the Pyrenees and Paris. Type: 2 ♂♂ labelled "ex coll Spinola scat'117/2" SCT! might be syntypes (Kellner-Pillaut in litt.).

Apathus quadricolor auctt. nec *P. q. quadricolor* Lepeletier; Thomson 1870 (partim).

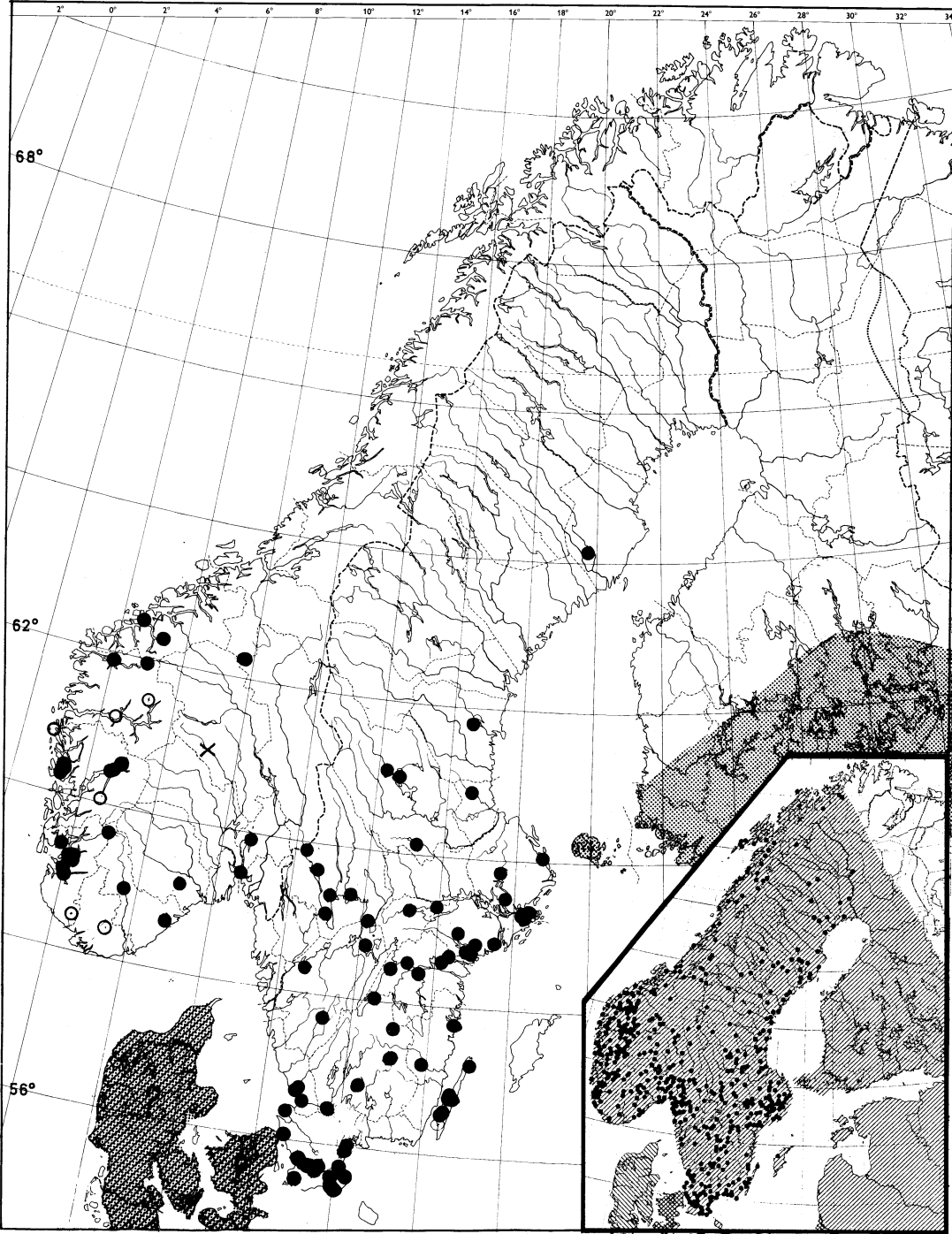


Fig. 29. *P. quadricolor globosus* Eversmann. Inset: The host *B. s. soroensis* (Fabricius), updated 1983. ? = possible intergradation zone between *P. q. globosus* and *P. q. meridionalis* Richards. Legend as in Fig. 25.

Psithyrus quadricolor auctt. nec Lepeletier; Sp. Schneider 1898, 1909, 1918; Friese 1902; Aurivillius 1903; Strand 1904; Soot-Ryen 1925; Bengtsson 1931. *Apathus sylvestris* (Lepeletier); Thomson 1872; Siebke 1880; Strand 1898b.

Psithyrus sylvestris Lepeletier; Richards 1928; Meidell 1934; Barendrecht 1941; Tjeder 1954; Ander 1963, 1965; Løken 1966b; Kullenberg et al. 1970; Bringer 1973; Lundberg & Svensson 1977; Svensson 1980.

Taxonomical remarks

P. sylvestris var. *citrinus* Schmiedeknecht, *P. s.* var. *albicans* Richards and *P. s.* var. *atrithorax* Richards one or several of which mentioned by Sp. Schneider (1898, 1909), Richards (1928), Barendrecht (1941) are infrasubspecific forms occurring occasionally throughout Scandinavia.

First Scandinavian records

Norway: Tromsø (Sp. Schneider 1898).

Sweden: Distributed north to Lapland (Thomson 1872).

Description

FEMALE

Body small. Coat shaggy.

Measurement. $N = 25$. $RI: 3.56 \text{ mm} \pm 0.129$, $3.30\text{--}3.80 \text{ mm}$; $Iw: 4.47 \pm 0.209 \text{ mm}$, $4.20\text{--}5.00 \text{ mm}$; $Hw: 4.23 \pm 0.123 \text{ mm}$, $4.00\text{--}4.40 \text{ mm}$; hamuli number: 21.52 ± 1.531 , $19\text{--}24$; $Lh: 1.48 \pm 0.081$, $1.23\text{--}1.60 \text{ mm}$; $Dh: 0.072 \pm 0.004 \text{ mm}$, $0.067\text{--}0.081 \text{ mm}$.

Head. Malar space usually just longer than A_{3+4} ; integument smooth with irregular, close punctures of varying sizes anteriorly fading into a large almost impunctate area. Main keel of mandible well developed, reaching margin or almost so, tapering distally (Fig. 11A). Upper gena with distinct, usually dense mixture of fine and coarse punctures; genal furrow indistinct, occasionally absent. Surface of scapus smooth, shiny, rather sparsely haired. $A_3:A_4:A_5 = 17:10.5:14$, A_{6-12} as long as their width.

Hind leg. Tibia with longest hairs of posterior fringe about $1.5\times$ its greatest width; Bt with longest hairs about as long as its greatest width.

Gaster. Punctuation of T_5 as that of T_{3-4} or slightly sparser. T_6 closely punctured except along

a median longitudinal line usually forming an indistinctly interrupted keel (Fig. 11B). St_6 with narrow angled callosities (Fig. 11C).

Colour pattern. Pile of vertex with a variable admixture of yellow. Broad yellow collar laterally covering adjacent border of episternum. Lateral patches of T_3 more or less extending inwards along extreme distal margin and T_4 with white hairs. T_6 and St_6 between and outside callosities covered by pale ferruginous to pale brownish pubescence. Coat otherwise black.

Variation. Pile of vertex ranging from all yellow to all black. Pile on T_3 ranging from all white to rarely all black. Fringes of legs, particularly Bt, pale yellowish or tipped so.

MALE

Body small. Coat shaggy.

Measurements. $N = 50$. $RI: 3.23 \pm 0.148 \text{ mm}$, $2.80\text{--}3.55 \text{ mm}$; $Iw: 3.51 \pm 0.471 \text{ mm}$, $3.00\text{--}3.90 \text{ mm}$; $Hw: 3.92 \pm 0.139 \text{ mm}$, $3.55\text{--}4.30 \text{ mm}$; hamuli number: 18.30 ± 1.389 , $15\text{--}21$; $Lh: 1.24 \pm 0.073 \text{ mm}$, $1.10\text{--}1.38 \text{ mm}$; $Dh: 0.072 \pm 0.006 \text{ mm}$, $0.06\text{--}0.09 \text{ mm}$.

Head. Malar space about as long as distal width equal to A_{3+4} or just longer; integument smooth with rather sparse, fine and medium-sized punctuation distally fading into an almost impunctate area of various size. Upper gena usually with close, distinct and mainly coarse punctuation; genal furrow indistinct. Scapus shiny, smooth rather sparsely haired. $A_3:A_4:A_5 = 16:11:17$, A_{6-13} about $1.5\times$ their distal width.

Hind leg. Tibia with longest hairs in posterior fringe about $1.5\times$ its greatest width; Bt's longest hairs almost $2\times$ its greatest width.

Gaster. St_6 distally slightly protuberant, truncate, more or less bilobed (Fig. 23A). St_{7-8} and genitalia as in Fig. 23B–E; inner basal extensions of gonocoxite usually slender, longer than wide; gonostylus varying in shape (Fig. 23D–E), inner margin concave, usually about as long wide and about as long as that part of volsella visible from above (Fig. 23D).

Colour pattern. Pile of vertex with varying admixture of yellow. Broad yellow collar laterally covering upper part of episternum. T_1 with varying admixture of whitish and yellow hairs. Hairs of T_{3-4} and lateral patches of T_5 whitish, hairs of T_{6-7} predominantly ferruginous or whitish. Otherwise coat black.

Variation. Distal fringe of scutellum and T₂ with slight admixture of whitish or pale yellow hairs. Hairs of anterior lunate part of T₃ black, occasionally T₃ with all hairs black except small lateral whitish patches. T₃₋₄ occasionally with yellow hairs, hairs of T₅ predominantly to entirely whitish, T₆ with variable admixture of black hairs on the disc. Fringes of tibia and Bt tipped ferruginous or pale yellow, occasionally posterior fringe of hind Bt all ferruginous. Completely melanic specimens have been recorded as have melanic individuals with only last 2 tergites with paler hairs.

Host

Bombus pratorum (L.) (Hoffer 1889; Richards 1928; Pouvreau 1973; Alford 1975; Cederberg (in litt.); Mjelde (in litt.)). Once recorded established in a colony of *B. jonellus* (Kirby) (Richards 1928).

Flight season

Southern Sweden: Hibernating female: 21 April–4 August; female progeny: 19 June–4 September; male: 6 June–18 September. A male collected 9 October 1929 (SM: Fågelfors C.B. Gaunitz leg. ZML!) is a surprising late record for this species.

Distribution

Scandinavia (Fig. 30). Widely distributed throughout the peninsula north to about 69°45'N, the northernmost records so far are from Norway: TRy: Tromsø. The species is together with *P. bohemicus* the most abundant Scandinavian species, occurring from sea level to the treeline and locally penetrating regio subalpina/subarctica.

A total of about 970 Norwegian and 1875 Swedish specimens were examined. Unrevised records (Fig. 30) refer to Meidell (1934) and Ander (in litt.).

Corrections: Specimens from localities listed by Siebke (1873, 1880) and referred to by Strand (1898b) and 1♀3♂♂ TO: Abisko (Bengtsson 1931) were revised to *P. flavidus*.

World distribution. Eurosiberian. Western Europe (excl. the Mediterranean islands) – northern half of European USSR – from Turkey east to Pacific Ocean (Kamtschatka, Korea).

The distribution of the species is within that of *B. pratorum* (Løken 1973).

Psithyrus (*Fernaldaepsithyrus*) *flavidus* (Eversmann)

Figs. 13, 24, 31–33.

Bombus flavidus Eversmann, 1852:131. Type locality: USSR: Irkutsk. Syntypes: 2♂♂ MAL!

Psithyrus flavidus (Eversmann); Popov 1931; Barendrecht 1941; Pittioni 1942; Brinck & Wingstrand 1949; Brinck 1951; Peters 1974, 1975; Svensson 1974, 1979, 1980; Lundberg & Svensson 1977; Wollin 1975.

Bombus autumnalis Zetterstedt, 1838 nec Fabricius 1793, the male; Dalla Torre 1896:570.

Apathus lissonurus Thomson, 1872:49, No. 7. Type locality: Sweden: Lapland. Lectotype ♀ TCL! (Ander 1967); Schmiedeknecht 1883; Strand 1898a, b.

Psithyrus lissonurus (Thomson); Schøyen 1881; Strand 1901; Friese 1902; Aurivillius 1903; Bengtsson 1904, 1931; Sp.. Schneider 1909, 1918; Lundblad 1924; Soot-Ryen 1925; Richards 1928; Meidell 1934; Ander 1963, 1965, 1967; Wollin 1975.

Psithyrus quadricolor st. *lissonurus*: Dalla Torre 1896.

Psithyrus flavidus lissonurus (Thomson); Stoeckert 1933.

Taxonomical remarks

P. lissonurus var. *atricolor* Richards, type ♀ TRM!, *P. l.* var. *alpium* Richards (Richards 1928), *P. flavidus* f. *latofasciatus* Pittioni and *P. f.* *f. thomsoni* Pittioni, mentioned for Scandinavia are infrasubspecific forms.

First Scandinavian records

Norway: Bv: Ål (Strand 1898a).

Sweden: TO: Kengis (Dahlbom 1832). The record is a male ZCL! collected by Zetterstedt 22 August 1821, misidentified as *P. campestris* by Dahlbom (1832), as *B. autumnalis* ♀ by Zetterstedt (1838) and revised to *P. lissonurus* ♂ by Thomson (1872).

Description

FEMALE

Coat shaggy. Body small.

Measurements. Lapland. N = 25. RI: 3.74 ± 0.166 mm, $3.25\text{--}3.95$ mm; Iw: 4.38 ± 0.216 mm, $4.00\text{--}4.80$ mm; Hw: 4.24 ± 0.159 mm, $3.80\text{--}4.60$ mm; hamuli number: 19.92 ± 1.288 , $16\text{--}22$; Lh: 1.40 ± 0.077 mm, $1.20\text{--}1.50$ mm; Dh: 0.074 ± 0.004 mm, $0.066\text{--}0.085$ mm.

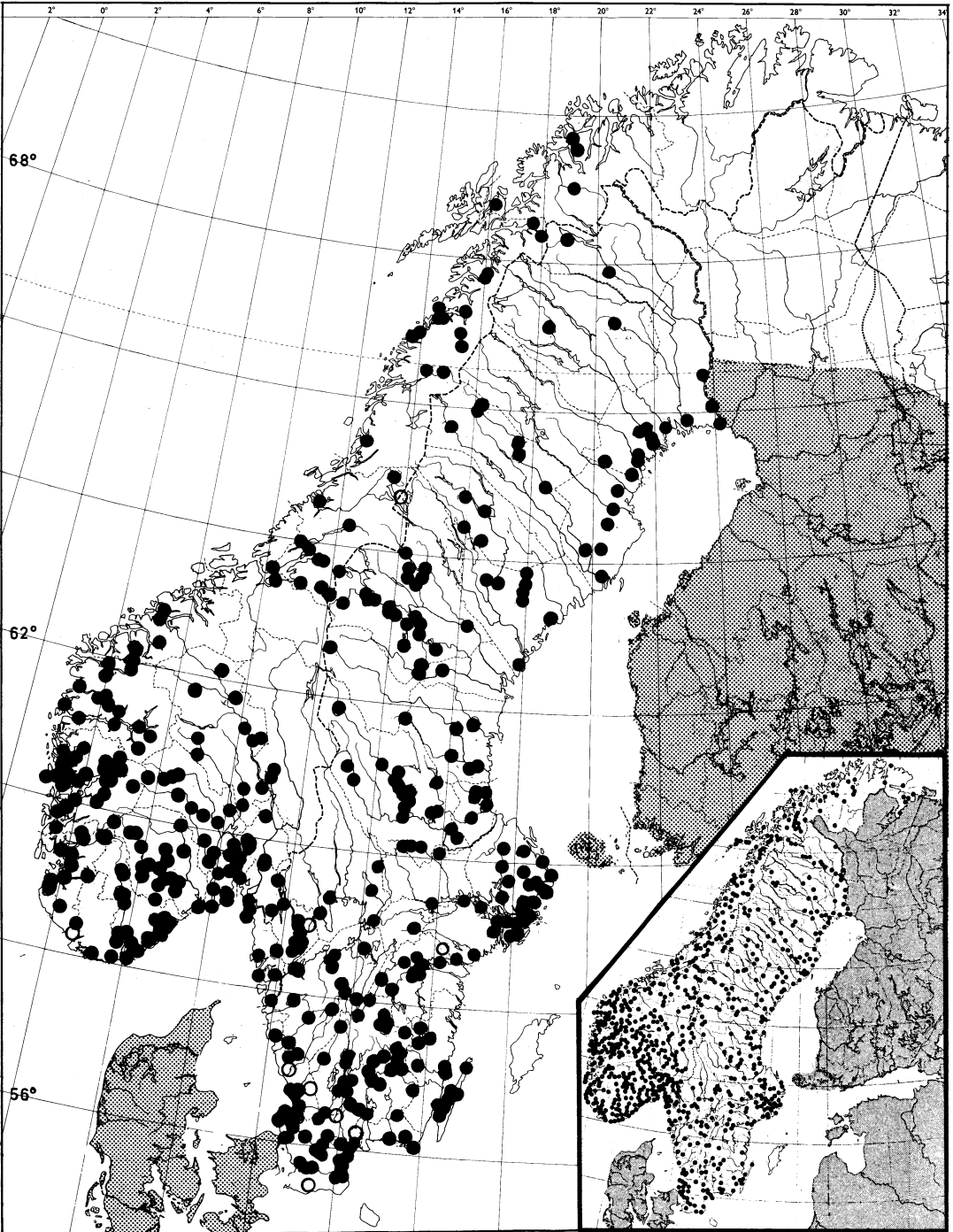


Fig. 30. *P. sylvestris* Lepeletier. Inset: The host *P. pratorum* (L.), updated 1983. Legend as in Fig. 25.

Head. Malar space as long as A_{3+4} or just longer; surface smooth, occasionally striate/rugose at the base with irregular, mainly medium-sized punctures becoming finer and sparser towards anterior mandibular condyle and distal margin. Main keel of mandible well developed, reaching about $2/3$ down to margin, distally tapering or acutely pointed. Upper gena with irregular mainly coarse punctation, close to eye admixed minute punctures; genal furrow absent, occasionally indistinct. Scapus rather densely haired, $A_3:A_4:A_5 = 17:10.5:13$, A_{6-12} each about as long as wide.

Hind leg. Tibia and Bt with longest hairs in posterior fringe about $1.5\times$ their greatest width.

Gaster. T_5 markedly sparser punctured than T_{3+4} . T_6 with minute, sparse punctures on the disc and an indistinct median longitudinal keel (see Fig. 11B). St_6 with evenly curved narrow callosities (Fig. 13).

Colour pattern (Fig. 31H). Pile of vertex, broad collar just passing adjacent margin of episternum, crescent-shaped posterior part of scutellum and T_4 yellow. T_6 and St_6 outside and between distal part of callosities with ferruginous pubescence. Fringes of sternites with slight admixture of pale hairs. Fringes of all legs pale ferruginous, yellowish or just tipped so. Coat otherwise black.

Variation (Fig. 31I). Yellow hairs of vertex laterally extending part way along preoccipital ridge. Collar extending part way down episternum. Pile of scutellum ranging from all yellow to predominantly black. Fringes of legs rarely all black. T_3 with small lateral yellow patches, hairs of T_4 occasionally all whitish, of T_5 laterally whitish or yellowish. Two ♀♀ have hairs of gaster completely black, one was labelled var. *atricolor* by Richards (1928).

The colour pattern is similar to that of the females in Russia and northern Siberia (Popov 1931).

MALE

Body of medium size. Coat long and shaggy.

Measurements. $N = 50$. $RI: 3.33 \pm 0.133$ mm, 3.00–3.60 mm; $Iw: 3.58 \pm 0.173$ mm, 3.20–3.90 mm; $Hw: 3.98 \pm 0.134$ mm, 3.70–4.25 mm; hamuli number: 17.22 ± 1.345 , 15–20; $Lh: 1.22 \pm 0.072$ mm, 1.08–1.40 mm; $Dh: 0.076 \pm 0.006$ mm, 0.06–0.09 mm.

Head. Malar space slightly longer than distal width, as long as A_{3+4} or almost so; integument

smooth with rather sparse fine or medium-sized punctures distally fading into an impunctate area of varying size. Upper gena with irregular, mainly medium-sized, shallow punctures; genal furrow usually indistinct. Scapus feebly alutaceous, densely haired. $A_3:A_4:A_5 = 17:11:16$, A_{6-13} about $1.5\times$ their distal width.

Hind leg. Tibia and Bt with longest hairs in posterior fringe at least $2\times$ longer than their greatest width.

Gaster. St_6 with distal margin oval, slightly or not elevated (Fig. 24A), occasionally protuberant and truncate. St_{7-8} and genitalia as in Fig. 24B–E; inner basal extension of gonocoxite usually rather flattened, slightly longer than wide; gonostylus varying in shape, usually longer than wide, shorter than that part of volsella visible from above and inner margin straight (Fig. 24D); occasionally approaching the shape of the gonostylus of *P. sylvestris* (Fig. 24E).

Colour pattern varies from pale dirty yellow-banded to pronounced melanic forms (Fig. 31A–G). The pale coloured forms (Fig. 31A–B) agree with the typical form (Eversmann 1852) and the intermediate (Fig. 31C–E) roughly with that of *P. lissonurus* (Thomson 1872). There is no strict correlation between the colour variation in thorax and gaster.

The following details demonstrate the unstable colour pattern: Pile of vertex all yellow or with a variable admixture of black; yellow hairs may laterally extend part way along preoccipital ridge. Yellow collar varies in width and may extend part way down episternum. Pile of scutellum, T_{1-3} ranging from all yellow to all black, rarely pile on T_{1-2} replaced by whitish. T_5 with small yellow or whitish patches laterad. Pile on T_6 ranging from all ferruginous to all black, occasionally yellow hairs admixed. Fringes of at least St_{4-6} ranging from pale yellow, whitish or ferruginous to all black. Posterior fringes of legs ranging from ferruginous to pale yellowish or tipped so; occasionally fringes of fore- and midlegs all black, rarely hairs of all legs black. Otherwise coat black.

Melanism. The frequency and the degree of melanism in males are illustrated on the pie chart (Fig. 32) based on figures given in Tab. I. Areas represented by less than 5 individuals are omitted. The specimens were grouped as pale coloured forms (Fig. 31A–B), intermediates (Fig. 31C–E)

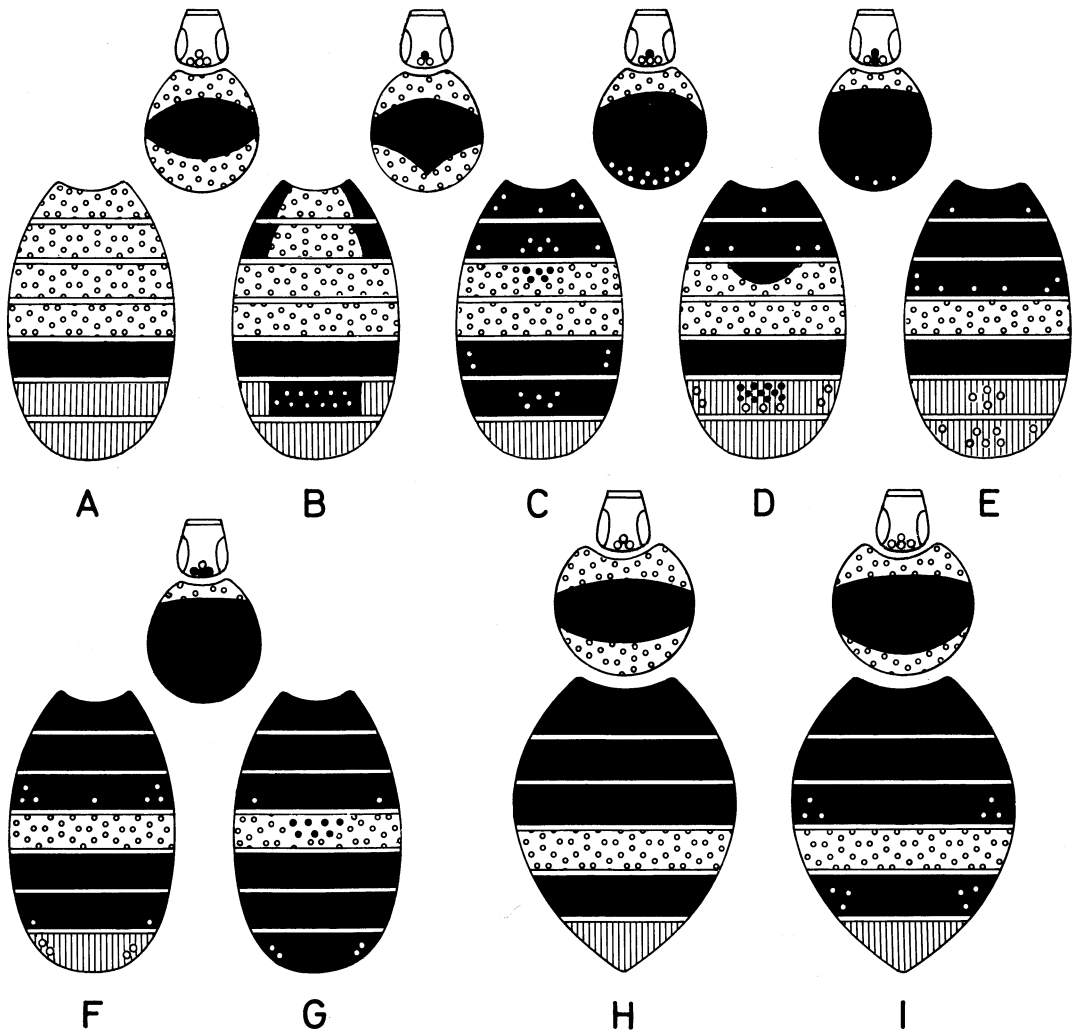


Fig. 31. *P. flavidus* (Eversmann). Variations in the colour pattern of the Fennoscandian populations, see the text. A–G = males, H–I = females. Black = black, o = yellow, ● = black, vertical lines = ferruginous.

and melanics (Fig. 31F–G). The pie chart demonstrates a pronounced tendency towards melanism throughout the Scandinavian peninsula, intermediates and melanic specimens everywhere being in majority. The examined Finnish males indicate a slight decrease in melanism to the east. However, more Finnish males and representative material from the USSR are needed to evaluate the proportion of melanism east of Scandinavia. Melanism occurs at least as far east as Tobolsk in western Siberia (Popov 1931; Pittioni 1942).

Conclusion

The rather stable colour pattern of the females argues against subdividing the Scandinavian population of *P. flavidus*. It belongs to the nominate subspecies as indicated by Popov (1931).

Host

?*Bombus jonellus* (Kirby) (Brinck 1951). Two *P. flavidus* ♀♀ and one *B. jonellus* ♀ were found in a colony of *B. jonellus* located in an old rodent's

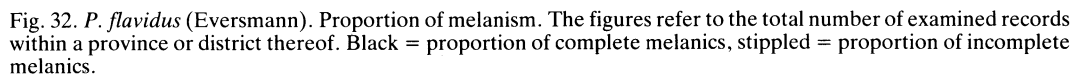


Table I. Proportion and degree of melanism in *P. flavidus* (Eversmann). Area = province or district thereof (cf. Fig. 35).

Area	Number of individuals			Total		Per cent	
	Typ. form	inter-medicates	mel. form	number	typ. form	inter-medicates	mel. form
Norway:							
Os	1	4	3	8	13	50	37
On	3	19	4	26	12	73	15
Bv	1	37	30	68	1	54	44
HOi	0	7	3	10	0	70	30
SFi	1	5	1	7	14	72	14
TRi	4	16	4	24	17	68	17
Fø	2	9	2	13	15	70	15
Sweden:							
DR	4	27	2	33	12	82	6
JÄ	3	3	23	29	10	10	80
VB	1	11	5	17	6	65	29
NB	30	32	60	122	25	26	49
ÅS	0	3	3	6	0	50	50
LY	5	5	47	57	9	9	82
PI	2	3	7	12	17	25	58
LU	17	15	88	120	14	13	73
TO	19	119	38	176	11	68	22
Finland:							
Kb	1	9	1	11	9	82	9
Ok	14	21	1	36	39	58	3
Ob	4	9	1	14	29	64	7
Lk	6	10	7	23	26	44	30
Le	18	49	12	79	23	62	15
Li	5	3	0	8	63	37	0
USSR:							
Petsamo	4	6	15	25	16	25	60
Total	145	418	361	924			

nest (Sweden: LU: Virihaure 8.VII.1944 ZML). The colony was not analyzed and the presence of a *B. jonellus* ♀ makes it uncertain whether it was usurped by *P. flavidus* or the inquilines were temporarily resting in the nest. The 2 specimens are the only records of *P. flavidus* observed in a bumble bee colony.

Bombus lapponicus s.l. (= *B. lapponicus* (Fabricius) and *B. monticola* (Smith)) has been considered as host of *P. flavidus* (Richards 1928; Pittoni 1942, 1943; Tkalců 1969; Lundberg & Svensson 1977; etc.) based on the fact that *B. lapponicus* s.l. and the inquiline are boreo-alpine species locally observed in the same areas. Pittoni (1942) in recognizing that *P. flavidus* has a wider distribution than *B. lapponicus* s.l. in Finland, proposed *B. cingulatus* Wahlberg as a second host. Pekkarinen et al. (1981) confirmed that in E

Fennoscandia *P. flavidus* occurs markedly further south than *B. lapponicus* s.l.; they suggested the widespread *B. jonellus* might be the only host of this inquiline in Finland. The present study reveals that *P. flavidus* has a wider distribution in Scandinavia than that of *B. lapponicus* s.l. or *B. cingulatus* (cf. below).

Until more colonies invaded by *P. flavidus* are recorded it remains question whether *B. jonellus* is preferred host (cf. p. 34). The inquiline resembles *B. jonellus* in colour pattern and is widely distributed within the range of this *Bombus* species (cf. below). Difference in colour pattern and in ecological valence may, however, not prevent the species from attacking colonies of *B. lapponicus* s.l. or *B. cingulatus*. The 3 *Bombus* species suggested as hosts of this inquiline are all belonging to the subgenus *Pyrobombus* Dalla Torre.

Flight season

Swedish Lapland: Hibernating females: 2 June – 13 August; female progeny: 6 July – 17 September. Male: 1 July – 17 September.

A female recorded at sea level as early as 15 May 1946 (Norway: SFi: Leikanger ZMB!) suggests earlier appearance at lower altitude and under mild local conditions in the western fjords. Two ♀♀ collected in lower alpine zone 15–16 May 1948 (Norway: Bv: Hol: Ustaoset 1000 m) (Valkeila in litt.) demonstrate that the inquiline occasionally emerges from hibernation contemporarily with its host.

Distribution

Scandinavia (Fig. 33). Widely distributed from about 59°30'N north to sheltered habitats at the arctic coast, everywhere within the range of *B. jonellus*; confined to the lower alpine, subalpine/subarctic and boreal zones. The dominant *Psithyrus* species above the timberline and locally so in southern and northern boreal zones. West of the mountain chain occasionally observed in the boreonemoral zone at sea level in the inner part of the fjords. In southern Norway recorded up to 1100 m.

The great abundance of this species in the southern and central boreal zone east to the Gulf of Bothnia is noteworthy; in areas where *B. jonellus* is abundant (Fig. 33), *B. lapponicus* s.l. is absent and *B. cingulatus* occurs locally (Løken 1973, 1978). During observations throughout Västerbotten and Norrbotten in the last half of July 1976 almost every flowering plant of the commonly growing *Solidago virgaurea* L. was crowded with *P. flavidus*.

Locally abundant. A total of about 225 Norwegian and 900 Swedish specimens were examined.

List of localities: Norway: HES: Sør-Odal: Mård ZMO. HEN: Åmot: Åmot ZMO. – OS: Gausdal: ZMO; Øyer: Aksjø, Øyer, Åstdalsætra; Nord-Aurdal: Flya. ON: Vestre Slindre: Kinnholdt; Vang: Øylo; Sel: Heidal, Heidal kirke, Mysusæter; Vågå: Hindseter, Klones, Leirungen, Randsverk TRM; Lom: ZMO; Lesja: Nordmannseter, Skamsdalen, Ulateig; Dovre: Dovrefjell KMT ZMO, Fokstua, Hjerkinntunet ZMO. – BØ: Modum: ZMO; Flesberg: Hvila. BV: Sigdal: Kopseng, Nedre Eggedal; Hemsedal: Lykkja; Ål: MNB ZMA ZMO; Hol: Geilo ZMA ZMB, Haugastøl ZMA ZMB, Nygård, Ustaoset ZMA, Vikastølven; Uvdal: Bjørkeflåtå, Dagali, Nørstebo, Sønstevenn. – TEI: Rauland: Rauland; Tinn: Børsjøen. – HOY: Bergen: Fana, Hop, Skipanes ZMA. HOI: Eidfjord: Fossli, Måbødalen; Voss: Han-

gurfjellet. – SFY: Gaular: Haukedal. SFi: Lærdal: MNB ZMA; Leikanger: Njøs; Sogndal: Kaupanger, Slindre; Balestrand: Brekka; Luster: Fåberg. – STI: Oppdal: Kongsvoll TRM ZMA; Trondheim: ZMA ZMB. – NSY: Vevelstad: Aursletta; Bodø: Falkflaugdalen: Nsi: Rana: Røvassdal TRM; Saltdal: ZMO, Storjord TRM; Fauske: Kjeldvatnet S Sulitjelma BML. NNØ: Hamarøy: Fjerdevann; Ankenes: Katteratt SNBS. – TRY: Tromsø: Tromsø TRM, Tromsø TRM, Ullsfjord SMS. TRI: Målselv: Bjerkeng MNB TRM ZMA ZMB, Frihetsli TRM; Balsfjord: Lanes TRM; Storfjord: Signaldalen TRM. – FI: Karasjok. FN: Porsanger: Kistrand ZMO; Vadsø. FØ: Sør-Varanger: Fiskvatn, Grensejacobselv TRM, Kirkenes TRM, Lyngbukta, Neiden TRM.

Correction. Specimens from Bv: Ål ZMO published as *Apathus lissomurus* (Strand 1898a) comprise 10 individuals of which 1 ♂ was revised to *P. norvegicus* and 3 ♂♂ to *P. sylvestris*.

Sweden: DR: Bingsjö NRS ZMB, Falun NRS, Idre Töfssingpark NRS, Ludvika NRS, Mora CBJS, Sandsjö, Stora Tandån NRS ZML, Tällberg NRS. – HS: Delsbo, Los NRS. – HÅ: Vemdalen. – JÅ: Åspås, Hallen, Hålland NRS, Järpen, Storlien, Svenstavik, Undersåker, Åre. – ÅN: Gräsmyr ZMB, Härnösand, Junsele ZMB, 55 km SE Åsele ZMB, Orsjön W Härnösand. – VB: Andersfors 50 km SW Skellefteå ZMB, Brännland ZMB, Degerfors NRS, Fällfors ZMB, Krångfors ZMB, Ljusvattnet ZMB, Skellefteå ZMB, Vindeln ZMB, Vännäs ZMB, Åbyn ZMB. – NB: Anttis ZMA ZML, Björkfors NE Kalix ZMB, Boden NRS, Edefors ZMB, Gullträsk ZMB, Haparanda MNB ZMA ZML, Hemmingsmark ZMB, Junosuando ZMB, Juosengi ZMB, Kalix NRS ZML, Kengis MNB ZMA, Korpilombolo NRS, Kukola ZMB, Lakträsk ZMB, Luleå NRS ZMB ZMU, Luppjo ZMB, Luppjoberget ZMB, Nederluleå, Niemi ZMB, Pajala NMB NRS ZMB, Peräjävaara, Piteå, Rantajarvi ZMB, Sandträsk ZMB, Torneå RNL, Turtula by Övertorneå ZMA, Öjebyn, Överkalix NRS, Övertorneå ZMB ZML. – ÅS: Bångnäs, Saxnäs, Wilhelmina TCL. – LY: Arvträsk ZMB, Björkfors, Björksele ZMB, Fjällsjönäs, Klippen SNBS, Malå ZMB, Mårdsele ZMB, Norrbyberg ZMB, Ruskele ZMB, Sorsele NRS, Vindelgränsele ZMB, Vänjurbäck ZMB, Öravatn 30 km W Lycksele ZMB. – PI: Arjeplog NRS ZML, Araviken, Arvidsjaur ZMB. – LU: Jokkmokk, Malmberget NRS ZMB ZML, Messaure ZMB ZMU, Muddus NRS, Njunjes, Polarcirkeln ZMB, Ruotjajaur ZMB, Sarek, Sijtojaure, Staloluokta NRS ZML, Tarradalen NRS, Vietasjokk, Vuollerim ZMB. – TO: Abisko BML LHAS NRS SNBS ZMA ZML, Björkliden LHAS NRS SNBS ZMA ZML, Djupsviken in Björkdalen SNBS, Jebrenjokk NRS, Jukkasjärvi NRS, Kaisepakte NRS, Karesuando ZMB, 65 km E Karesuando ZMB, Kengis DCL, Kiruna NRS RNL SNBS, Kjärketjorror SNBS, Masungbyn ZMB, Mell-Meräsjärvi, Njulla LHAS SNBS, Parakka ZMB, Stenbäcken NRS ZMA, Torneträsk, Vassijaure NRS, Vietovare NRS.

Unrevised records (Ander in litt.): LY: Ammarnäs, Valle 30 km S Ammarnäs. – PI: Kaissats.

World distribution. Boreo-alpine. Europe (NW Spain; the Pyrenees; the Alps; Fennoscandia; northern part of European USSR). – Southern

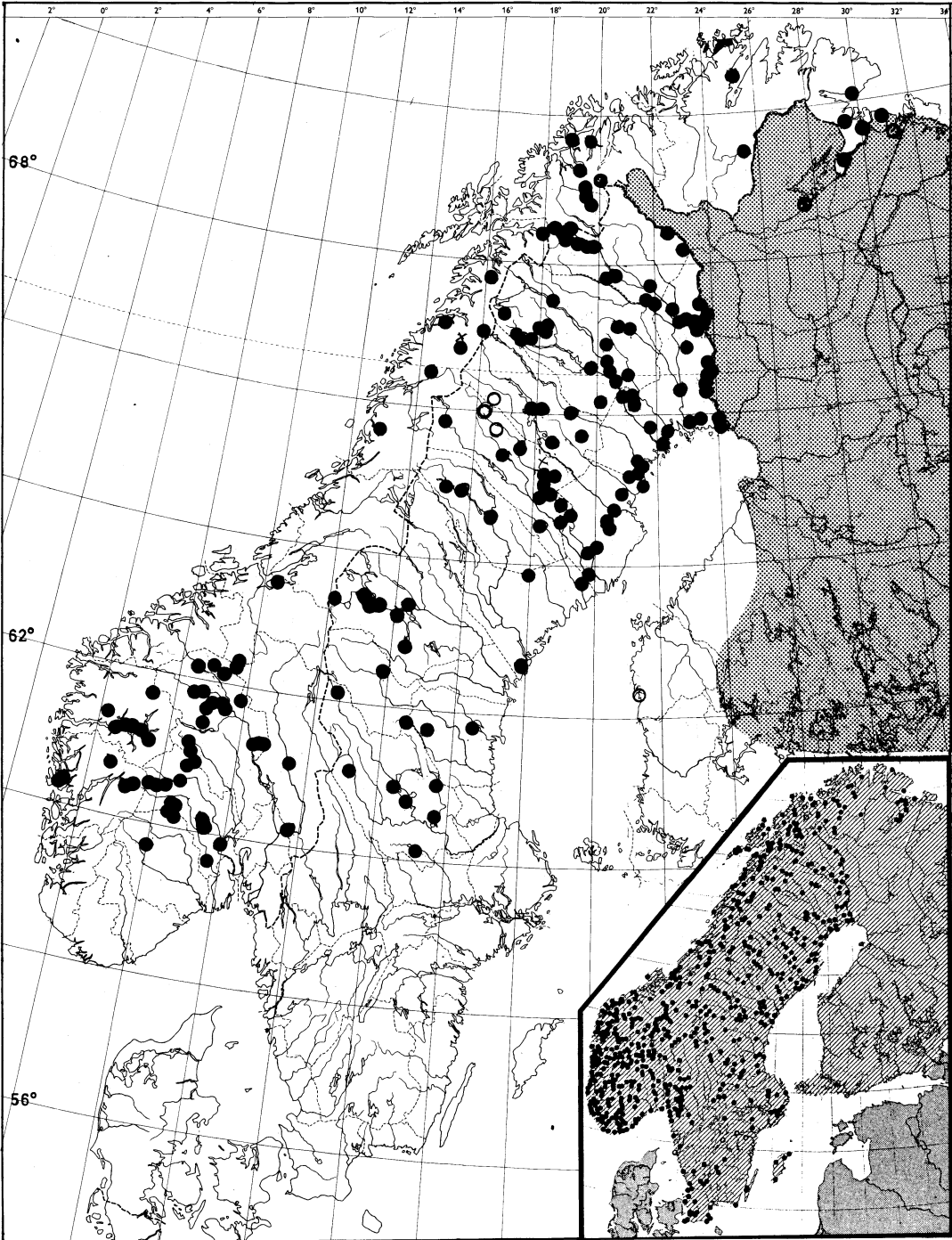


Fig. 33. *P. flavidus* (Eversmann). Inset: The supposed host *B. jonellus* (Kirby) updated 1983. Legend as in Fig. 25.

Urals – Siberia – Amur region – Kamchatka – the Kurile islands (Pittioni 1942; Sakagami 1950).

The distribution of *P. flavidus* is everywhere within the distribution of *P. jonellus* and only partly covered by the arcto-alpine *B. lapponicus* or the Siberian *B. cingulatus* (Løken 1973).

Psithyrus (Fernaldaepsithyrus) norvegicus Sp. Schneider

Figs. 12, 22, 34.

Psithyrus norvegicus Sp. Schneider, 1918:40. Type locality: Norway: Oslo. Lectotype ♀ TRM! hereby designated.

Psithyrus norvegicus Sp. Schneider; Richards 1928; Soot-Ryen 1925; Meidell 1934; Ander 1963, 1965; Peters 1974, 1975; Cederberg 1976; Svensson 1980.

First Scandinavian records

Norway: Oslo: Slemdal (Sp. Schneider 1918).

Sweden: ÖG: Linköping and DS: Kroppefjäll in Rostock (Ander 1963).

Type material

The description is based on 3 ♀♀, 2 of which are in coll. TRM and hereby designated lectotype and paralectotype.

The lectotype is labelled as follows: (1) "Slemdal i Aker Schn. 6.17"; (2) "norvegicus ♀" (handwritten); (3) "lectotype *Psithyrus norvegicus* Sparre Schneider ♀ design. A. Løken 1984". The specimen has lost right antenna, left A_{5-12} , the last 2 tarsal segments of right mid-leg, right hind tibia and tarsi and last 2 tarsal segments of left hind leg. Otherwise it is in good condition.

The paralectotype is labelled as follows: (1) "Slemdal i Aker Schn. 5-16"; (2) "norvegicus ♀" (handwritten); (3) "paralectotype *Psithyrus norvegicus* Sp. Schneider ♀ design. A. Løken 1984". The specimen has lost both antennae, last 2 tarsal segments of all right side legs, tarsi of left fore leg and tibia and tarsi of left hind leg. Otherwise it is in a fairly good condition.

Description of lectotype

Body large. Coat rather even.

Measurements. Rl: 4.50 mm; Iw: 5.30 mm; Hw:

4.90 mm; hamuli number: 23; Lh: 1.85 mm; Dh: 0.084 mm.

Head. Malar space hardly shorter than distal width, longer than A_{3+4} (left antenna); integument rather smooth with closely set punctures of varying sizes becoming sparser in front of inferior lower margin of eye and on the disc, and anteriorly fading into finely punctured, emarginated broad margin between mandibular condyles. Main keel of mandible broad, tapering distally, almost reaching margin. Upper gena with irregular, sparse, mainly shallow coarse punctures; genal furrow distinct. Or = 1.20 mm, Oe = 0.75 mm, i.e. Or almost $1.5 \times$ Oe. Scapus densely haired, $A_3:A_4 = 18:11$.

Hind leg. Tibia with longest hairs in posterior fringe slightly longer than its greatest width, Bt's longest hairs as long as its greatest width.

Gaster. T_{4-5} markedly more sparsely punctate than T_3 . T_6 with conspicuous median longitudinal keel (Fig. 12A) and with rather close distribution of punctures of varying size. Callosities of St_6 evenly curved (Fig. 12B).

Colour pattern. Pile of vertex, broad collar laterally covering adjacent edge of episternum and extending beneath tegula, yellow. Posterior fringe of scutellum admixed with a few yellowish-white hairs. Hairs of latero-posterior patch of T_1 , T_3 (except a small anterior lunate part) and T_4 whitish. T_6 and St_6 outside and between callosities covered with golden-brown pubescence. Coat otherwise black.

FEMALE

Supplementary description. Cf. also description of lectotype.

Measurements. N = 20. Rl: 4.38 ± 0.253 mm, 3.80–4.85 mm; Iw: 5.01 ± 0.252 mm, 4.60–5.65 mm; Hw: 4.64 ± 0.204 mm, 4.20–4.90 mm; hamuli number: 20.50 ± 1.50 , 18–24; Lh: 1.62 ± 0.135 mm, 1.33–1.85 mm; Dh: 0.083 ± 0.005 mm, 0.071–0.095 mm.

Head. Main keel of mandible reaching more than $2/3$ down to margin, distally more or less acute, rarely tapering and reaching margin or almost so. $A_3:A_4:A_5 = 17:11:15$.

Hind leg. Tibia and Bt with longest hairs in posterior fringe slightly or not at all exceeding their greatest width.

Colour pattern. Cf. description of lectotype.

Variation. Hairs on T_1 black. Lunate part of T_3 with black hairs varying in size, occasionally hairs of T_3 all white. T_5 with small whitish patches laterad. Pale hairs on gaster occasionally more yellow than whitish.

MALE

Coat rather even. Body large.

Measurements. N = 40. RI: 3.78 ± 0.083 mm, 3.35–4.15 mm; IW: 3.70 ± 0.183 mm, 3.25–4.05 mm; Hw: 4.22 ± 0.132 mm, 3.80–4.50 mm; hamuli number: 17.58 ± 1.130 , 15–20; Lh: 1.30 ± 0.071 , 1.13–1.46 mm; Dh: 0.080 ± 0.006 mm, 0.068–0.092 mm.

Head. Malar space slightly longer than wide, about as long as A_{3+4} ; integument smooth with uniform moderate distribution of mainly minute punctures becoming sparser in front of inferior lower margin of eye and close to distal margin. Upper gena with irregular, shallow punctures which are particularly coarse and close along border of eye; genal furrow distinct. Scapus coarsely punctured, densely haired. $A_3:A_4:A_5 = 16:12.5:20$, $A_{6-13} 1.75 \times$ their distal width.

Hind leg. Tibia and Bt with longest hairs in posterior fringe rarely longer than $1.5 \times$ their greatest width.

Gaster. St_6 distally slightly protuberant with elevated margin more often inconspicuously bilobed than truncate. St_{7-8} and genitalia as in Fig. 22; inner basal extension of gonocoxite broad, flattened, slightly or not longer than broad (Fig. 22C); gonostylus varying in shape (Fig. 22C–E), usually broad, longer than that part of volsella visible from above, inner margin more or less concave and coarsely punctate (Fig. 22C); inner basal extension always with tuft of long fluffy hairs; basal part of volsella with markedly denser fringes than the remaining species of the subgenus.

Colour pattern. Pile of vertex laterally more or less extending along preoccipital ridge, collar covering adjacent border of episternum and extending backwards below tegula, yellow. Distal fringe of scutellum with slight admixture of whitish or pale yellow hairs, but more or less concealed by black hairs. Hairs of T_1 , extreme posterior margin of T_2 , T_{3-4} , T_{6-7} and fringes of St_{4-6} whitish. Otherwise coat black.

Variation. Hairs of T_1 yellow or with varying admixture of black hairs. Hairs of T_{3-4} more or less

yellow. Pile on T_{6-7} ranging from all whitish to all ferruginous or black.

Host

Bombus hypnorum (L.) (Stoeckert 1954; Röseler 1972; Cederberg 1976; Mjelde in litt.).

Flight season

Southern Sweden: Hibernating female: 3 May – 11 September; female progeny: ? – 5 August; male: 25 June – 15 September.

Distribution

Scandinavia (Fig. 34). Sparsely distributed throughout the peninsula north to almost $70^\circ N$. Occurring from sea level to timberline; rarely observed in subalpine/subarctic biotopes. Rare or absent along the extreme west coast of Norway where the frequency of the host *B. hypnorum* is markedly lower than inland.

A total of 110 Norwegian and about 190 Swedish specimens were examined.

List of localities. Norway. Ø. Onsøy: Rørvik; Moss: Jeløy ZMA; Hobøl: Tomter. – AK: Asker; Bærum: Burudvann; Høland: Skogen; Nittedal: Hakadal kirke. Oslo: TRM ZMB. – HEN: Rendal: Solbakken ZMO. – Os: Søndre Land: Enger MJEN; Nordre Land: Dokka; Gjøvik: Biri; Øyer: Tretten-Losna, Øyer. – Bv: Nore & Uvdal: Skjønne kirke; Ål: ZMO. – VE: Skoger: Konnerud; Nøtterøy: Teie. – TEY: Lunde: Vommestøl. TEI: Kviteseid: Kviteseid; Tinn: Våer. – AAy: Grimstad: Dømmesmoen. AAi: Bygland: Løndal; Valle: Kvestad, Rygnestad. – VAI: Hægeland. – HOy: Os: Stendalsetra; Bergen: Fantoft, Ytre Arna. HOi: Røldal: Røldal; Ulensvang: Fresvik, Lofthus, Ringøy; Ulvik: Hjeltnes, Ulvik. – SFi: Balestrand: Flesje; Luster: Leirdøla, Okleviki. – STi: Oppdal: Engan; Trondheim. – NTi: Meråker: Vardetun; Hegra: Hegra st.; Snåsa: Hegge. – TRy: Tromsø TRM. TRi: Bardu: Strømsmo TRM; Målselv: Bjerkeng TRM, Nordmo TRM.

Unrevised records (Varley, in litt.): SFi: Balestrand: Balholm, Mundal.

Sweden. SK. Alnarp, Brunneby, Fulltofta ZMA, Helsingborg NRS, Hörby, Kulla-Otorp (=Kulla-Gunnarstorp), Kullaberg, Lund ZMA, Skälderviken NRS, Strandbaden, Vegeholm NRS, Åhus NRS. – BL: Ronneby ZMB, Sjöarp NRS. – HA: Enslöv, Steninge. – SM: Aneboda, Gränna, Höreda NRS, Jönköping NRS, Ljungby ZMA, Österkorsberga ZML, ZMU. – ÖL: Borgholm NRS, Mörbylånga NRS. – ÖG: Borensberg. – VG: Händene NRS, Kinnekulle E Lidköping, Stenum E Skara NRS, Skatås E Gothenburg ZMA, Utbynäs NRS. BO: Brastad, Sämstad NRS. – SÖ: Enhörna NRS,

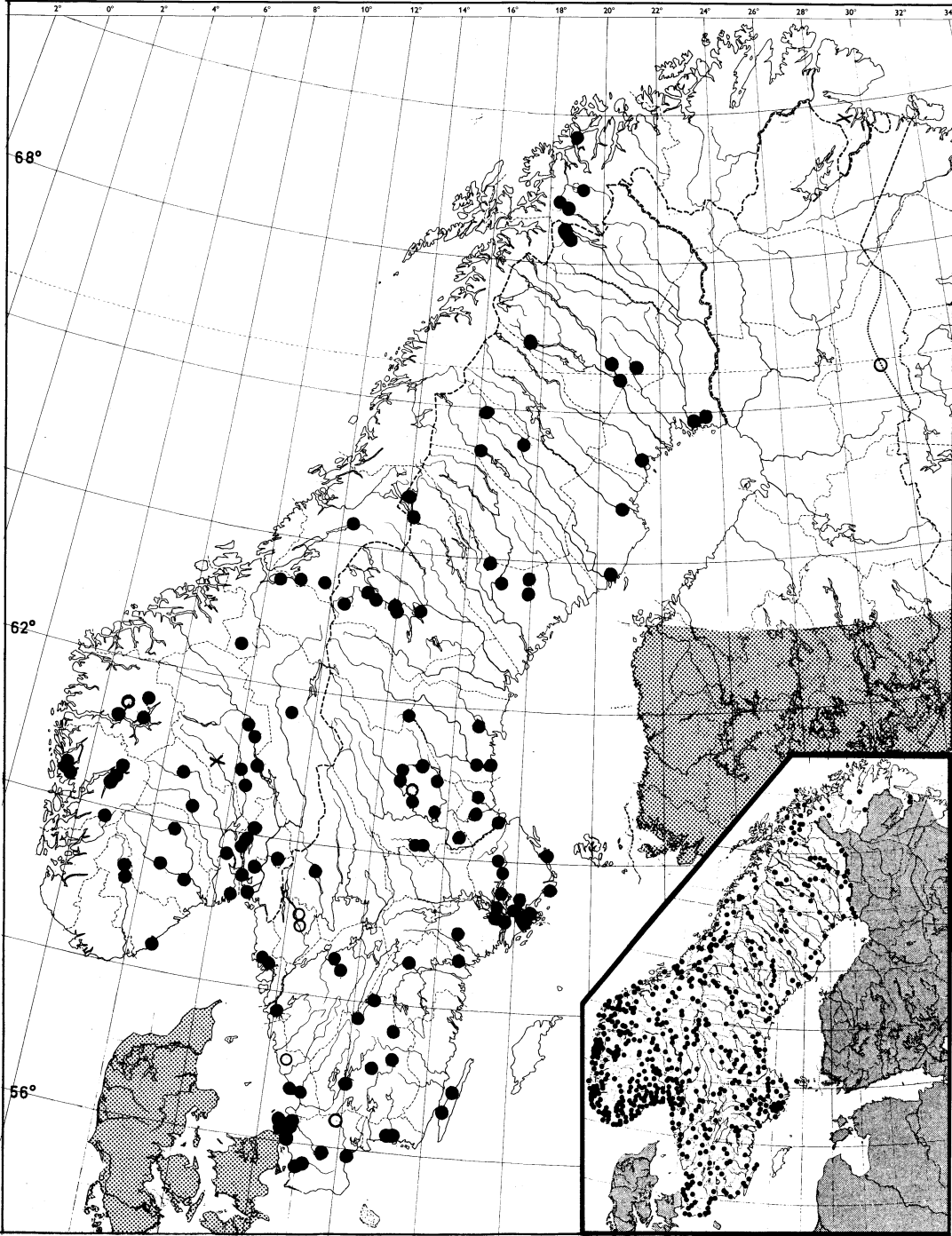


Fig. 34. *P. norvegicus* Sp. Schneider. Inset: The host *B. hypnorum* (L.), updated 1983. Legend as in Fig. 25.

Table II. Host records for European *Psithyrus*. N = number of *Bombus* colonies usurped by *Psithyrus*: + = 5–10 colonies, ++ = > 10 colonies, () = number of colonies recorded in Scandinavia, x = nonscandinavian species.

Social parasite	Host	N
<i>P. bohemicus</i>	<i>B. (s. str.) lucorum</i>	++
<i>P. vestalis</i>	<i>B. (s. str.) terrestris</i>	++
<i>P. barbutellus</i>	<i>B. (Megabombus) hortorum</i>	+
	<i>B. (Pyrobombus) hypnorum</i>	1
<i>P. rupestris</i>	<i>B. (Melanobombus) lapidarius</i>	++(1)
	<i>B. (Melanobombus) sicheli</i>	
	ssp. <i>alticola</i> ^x	2
	<i>B. (Thoracobombus) pascuorum</i>	2
	<i>B. (Thoracobombus) sylvarum</i>	2
<i>P. campestris</i>	<i>B. (Thoracobombus) pascuorum</i>	++
	<i>B. (Thoracobombus) humilis</i>	+
	<i>B. (Rhodobombus) pomorum</i>	1
	<i>B. (Pyrobombus) pratorum</i>	1
<i>P. quadricolor</i>	<i>B. (Soroceansibombus) soroceansis</i>	3
<i>P. sylvestris</i>	<i>B. (Pyrobombus) pratorum</i>	++(2)
	<i>B. (Pyrobombus) jonellus</i>	1
<i>P. flavidus</i>	<i>B. (Pyrobombus) jonellus</i>	(?)
<i>P. norvegicus</i>	<i>B. (Pyrobombus) hypnorum</i>	+(3)

Tyresö NRS, Uttran NRS, Valla NRS. – UP: Björklinge NRS, Ingarö, Fogdö NRS, Stockholm NRS ZML, Svartsjö, Uppsala, Vallentuna NRS, Yxlan. VR: Arvika. – DR: Bingsjö NRS, Brunnsvik NRS, Falun NRS, Horndal CBJS, Leksand TJTS, Ludvika NRS, Mora CBJS, Öre älv TJTS, Orsa, Sandsjö, Siljansborg NRS, Sjurberg NRS, Smedbacken, Tällberg NRS. – GÄ: Hille NRS, Öckelbo. – HÄ: Bergvik, Fredriksfors NRS, Söderhamn NRS. – JÄ: Gäddede NRS, Hallen, Hålland NRS, Jormlien, Mattmar, Snasahögarna NRS, Åre ZMU. – ÄN: Junsele ZMB, Knäsjö 65 km NW Örnköldsvik ZMB, SE Åsele ZMB. – VB: Skellefteå ZMB, Täfteå ZMU. – NB: Björkfors ZMB, Kalix, Öjebyn. – LY: Sorsele: Ammarnäs, Näckrostjärn. – LU: Messaure ZMB ZMU, Nattavaaraby ZMB, Njunjes, Vuollerim ZMB. – TO: Abisko BML, Djupviken LHAS.

Unrevised records (Ander, in litt.): SK: Osby. – HA: Åkulla NE Varberg. – DS: Bengtsfors, Långbron. – DR: Vikarebyn.

World distribution. Eurosiberian. Central and northern Europe – Siberia – Kamchatka – Transbaykal – Northern Mongolia. The only *Psithyrus* sp. recorded in Japan (Ito & Tadauchi 1981).

The range of *P. norvegicus* is within that of *B. hypnorum*, a Siberian fauna element (Løken 1973).

The host–parasite relationship *Bombus* – *Psithyrus*

The host species of the individual *Psithyrus* species mentioned above and the frequency of ur-

suped bumble bee nests (calculated from the figures of the host species references) have been compiled in Tab. II. Each *Psithyrus* sp. seems to prefer a certain *Bombus* sp. commonly occurring in Europe. Some species are more specific in their choice of host than others.

Scent is important for nest-seeking *Psithyrus* females (Sladen 1912; Pouvreau 1973). Recently Cederberg (1979, 1983) found that *P. rupestris* follows trail pheromone laid by *B. lapidarius*, the preferred host. Further experiments demonstrated that when given a choice, female *P. rupestris* at first reacted strongly to trail pheromone laid by *P. lapidarius* but after a few minutes they reacted as well to trail pheromone produced by *Bombus* spp. representing 5 different subgenera and left that laid by *B. lapidarius*. *P. rupestris* occasionally usurps other *Bombus* spp. than the preferred host (Tab. II).

According to Reinig (1981) 53 *Bombus* species occur in Europe (29 in Scandinavia (Løken 1973)), of which 14 species have been observed victimized by *Psithyrus* (Tab. II). A few more *Bombus* species repeatedly listed as host species without referring to usurped colonies (Reinig 1935; Pittioni 1942; Panfilov 1957; Pouvreau 1973; etc.) are not included in the table. It is, however, likely that other *Bombus* spp. occasionally are occupied by *Psithyrus*. *P. bohemicus*, *P. vestalis*, *P. norvegicus* and, possibly, *P. quadricolor* may be

strictly host specific; *P. barbutellus*, *P. rupestris*, *P. campestris* and *P. sylvestris* may invade bumble bee colonies regardless of species and subgenus if the preferred host is not available (Cederberg 1983; Tab. II).

More data on usurped bumble bee colonies are, however, needed in order to delimit host specificity and to justify this grouping of *Psithyrus* species suggested above. Trail pheromone is an important tool in locating a colony and selecting the host species (Cederberg 1983). Further research on responses of *Psithyrus* to the pheromones of sympatric *Bombus* species should improve our understanding of the relationships between the two genera.

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Index

Valid names in Roman type. Synonyms, homonyms, infrasubspecific forms in italics. In *Psithyrus* only those pages referring to description or taxonomic status are indexed. In *Bombus* only those pages referring to host species are indexed.

Psithyrus

<i>aestivalis</i> Panzer	10
<i>aestivalis</i> Dahlbom nec Panzer	8
<i>albicans</i> Richards	27
<i>alpium</i> Richards	28
<i>albinella</i> Kirby	14
<i>Allopsithyrus</i> Popov	12
<i>amoenus</i> Schmiedeknecht	8
<i>Apathus</i> Newman	14
<i>arenaria</i> Panzer	14
<i>arvernicus</i> Richards	23
<i>Ashtonipsithyrus</i> Frison	8
<i>ashtoni</i> (Cresson)	8
<i>atricolor</i> Richards	28
<i>atrithorax</i> Richards	27
<i>autumnalis</i> Zetterstedt	28
<i>barbutella</i> Kirby	12
<i>barbutellus</i> (Kirby)	12
<i>bohemicus</i> (Seidl)	8
<i>campestris</i> Panzer	18
<i>campestris</i> (Panzer)	18
<i>campestris</i> : Thomson	12
<i>citrinus</i> Schmiedeknecht	27
<i>distinctus</i> Pérez	8
<i>Fernaldaepsithyrus</i> Frison	22
<i>fernaldae</i> Franklin	22
<i>flavidus</i> Eversmann	28
<i>flavidus</i> (Eversmann)	28
<i>francisana</i> Kirby	19
<i>frutetorum</i> Panzer	14
<i>frutetorum</i> : Zetterstedt nec Panzer	23
<i>globosus</i> Eversmann	23
<i>intercalaris</i> Müller	23
<i>latofasciatus</i> Pittioni	28
<i>leana</i> Kirby	19
<i>lissonurus</i> Thomson	28
<i>maxillosus</i> (Klug)	12
<i>Metapsithyrus</i> Popov	18
<i>meridionalis</i> Richards	23
<i>nemorum</i> Fabricius	8
<i>norvegicus</i> Sp. Schneider	36
<i>obscurus</i> Seidl	14
<i>Psithyrus</i> Lepeletier (s. str.)	14
<i>quadricolor</i> Lepeletier	23
<i>quadricolor</i> auctt. nec Lepeletier	25
<i>rosiella</i> Kirby	19

<i>rosiellus</i> (Kirby)	19
<i>rossicus</i> Popov	23
<i>rupestris</i> Fabricius	14
<i>rupestris</i> (Fabricius)	14
<i>saltuum</i> Panzer	12
<i>svaveolens</i> Wahlberg	19, 23
<i>sylvestris</i> Lepeletier	25
<i>thomsoni</i> Pittioni	28
<i>vestalis</i> Geoffroy <i>in</i> Fourcroy	10
<i>vestalis</i> (Geoffroy <i>in</i> Fourcroy)	10
<i>vestalis</i> auctt. nec Geoffroy <i>in</i> Fourcroy	8

Bombus

<i>alticola</i> Kriechbaumer	16
<i>cingulatus</i> Wahlberg	33
<i>hortorum</i> (L.)	13

<i>humilis</i> Illiger	20
<i>hypnorum</i> (L.)	13, 37
<i>jonellus</i> (Kirby)	28, 31
<i>lapidarius</i> (L.)	16
<i>lapponicus</i> (Fabricius) s.l.	33
<i>lucorum</i> (L.)	10
<i>monticola</i> (Smith)	33
<i>pascuorum</i> (Scopoli)	16, 20
<i>pomorum</i> (Panzer)	20
<i>pratorum</i> (L.)	13, 16, 20, 25, 28
<i>proteus</i> Gerstaecker	24
<i>runderarius</i> (Müller)	13, 25
<i>sicheli</i> Radoszkowski	16
<i>soroeensis</i> (Fabricius)	24
<i>sylvarum</i> (L.)	16
<i>terrestris</i> (L.)	12

Abbreviations of provinces*Norway*

AA	= Aust-Agder
AK	= Akershus (incl. Oslo)
B	= Buskerud
F	= Finnmark
HE	= Hedmark
HO	= Hordaland (incl. Bergen)
MR	= Møre og Romsdal
N	= Nordland
NT	= Nord-Trøndelag
O	= Oppland
R	= Rogaland
SF	= Sogn og Fjordane
ST	= Sør-Trøndelag
TE	= Telemark
TR	= Troms
VA	= Vest-Agder
VE	= Vestfold
Ø	= Østfold

The suffixes (small letters) mean:

i	= indre (inner)
y	= ytre (outer)
n	= nordre (northern)
s	= søre (southern)
v	= vestre (western)
ø	= østre (eastern)
Ø	= Ø

Denmark

1	= Jylland
2	= the main islands
3	= Bornholm

Sweden

BL	= Blekinge
BO	= Bohuslän
DR	= Dalarna
DS	= Dalsland
GS	= Gotska Sandön
GÄ	= Gästrikland
GO	= Gotland
HA	= Halland
HS	= Hälsingland
HR	= Härjedalen
JÄ	= Jämtland
LU	= Lule Lappmark
LY	= Lycksele Lappmark
ME	= Medelpad
NB	= Norrbotten
NÄ	= Närke
PI	= Pite Lappmark
SÖ	= Södermanland
SK	= Skåne (Scania)
SM	= Småland
TO	= Torne Lappmark
UP	= Uppland
VB	= Västerbotten
VG	= Västergötland
VR	= Värmland
VS	= Västmanland
ÄN	= Ängermanland
ÄS	= Åsele Lappmark
ÖG	= Östergötland
ÖL	= Öland

Lapland (Lpl.) is divided into five Lappmarks.

Finland

Ab	= Regio aboënsis
Al	= Alandia
Ik	= Isthmus karelicus
Ka	= Karelia australis
Kb	= Karelia borealis
Kk	= Karelia keretina
Kl	= Karelia ladogensis
Kol	= Karelia olenetsensis
Kon	= Karelia onegensis
Kpoc	= Karelia pomorica occidentalis
Kpor	= Karelia pomorica orientalis
Ks	= Kuusamo
Kton	= Karelia transonegensis
Le	= Lapponia enontekiensis
Li	= Lapponia inarensis
Lim	= Lapponia Imandrae
Lk	= Lapponia kemensis
Lm	= Lapponia murmanica
Lp	= Lapponia ponojensis
Lps	= Lapponia petsamoënsis
Lt	= Lapponia tulomensis
Lv	= Lapponia Varsugae
N	= Nylandia
Oa	= Ostrobothnia australis
Ob	= Ostrobothnia borealis
Ok	= Ostrobothnia kajanensis
Om	= Ostrobothnia media
Sa	= Savonia australis
Sb	= Savonia borealis
St	= Satakunta
Ta	= Tavastia australis
Tb	= Tavastia borealis

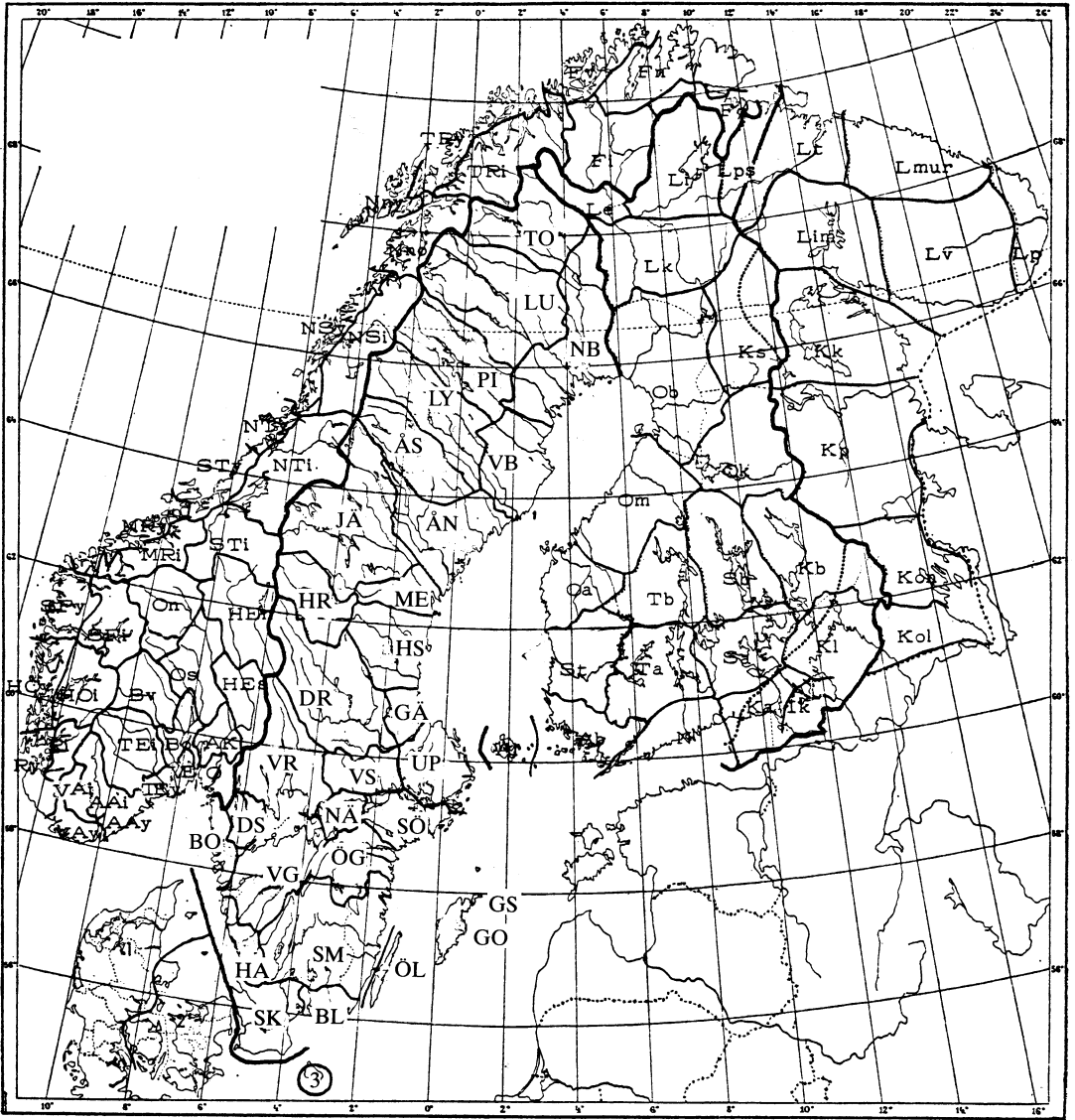


Fig. 35. Division of Fennoscandia and Denmark. For abbreviations of provinces, see p. 44.

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