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Formica paralugubris nov. spec. – a sympatric sibling species of *Formica lugubris* from the western Alps (Insecta: Hymenoptera: Formicoidea: Formicidae)

With 6 Figures and 3 Tables

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Abstract. *Formica paralugubris* nov. spec., a new sympatric sibling species of *Formica lugubris,* is described from the western Alps. *F. paralugubris* is well separable from *lugubris* in individual queens by means of several pilosity characters and size measures. Workers can be distinguished with a multiple discriminant function on the basis of nest sample means after removal of allometrically caused variance. The most powerful discriminators in workers are the pilosity characters on pronotum, ventrolateral propodeum and metapleuron. The species determination based on external morphology is in agreement with the results of earlier genetic studies and/or pupae carrying tests in nest samples from the Swiss Jura mountains. 11 nests genetically identified as 'type B' clearly belonged to *Formica paralugubris* and 8 nests identified as 'type A' showed the typical morphology of *Formica lugubris.* The external morphology provides no indication that *Formica paralugubris* is more closely related to *Formica aquilonia* than to *Formica lugubris* as suggested by earlier allozyme studies. The wood ant taxa *rufopratensis* FOREL, 1874, *santschii* WHEELER, 1913, *gaullei* BONDROIT, 1917, *grouvellei* BONDROIT, 1918, and *nylanderi* BONDROIT, 1919 were checked for synonymy with *Formica paralugubris* and belong to a different species.

1. Introduction

In 1967 HEINRICH KUTTER already demonstrated the existence of two different pilosity types within a large sample of wood ant queens of *Formica lugubris* ZETTERSTEDT, 1840 (KUTTER, 1967). Later he designated the long-haired queens as 'form I' and the shorter-haired queens as 'form II' of *Formica lugubris* (KUTTER, 1977). According to KUTTER form I was distributed throughout Fennoscandia, the British Isles and the Alps. Form II was restricted to the Western Alps and absent from Fennoscandia and the British Isles. Surprisingly the hot track of KUTTER was not followed by wood ant students and fell into oblivion.

During the last 18 years, a lot of biological investigations were performed on big polycalic colonies of *Formica lugubris* in the Swiss Jura mountains (e.g. GRIS & CHERIX, 1977; CHERIX & ROSENGREN, 1979; ROSENGREN & CHERIX, 1980; ROSENGREN & CHERIX, 1981; CHERIX, 1983; PASSERA et al., 1990; CHERIX et al., 1991; CHERIX et al., 1993; WALTER et al., 1993). Extensive studies on allozyme variation (PAMILO et al., 1992) gave a clear evidence that there were two genetically distinct, sympatric species of *'Formica lugubris'* in the Swiss Jura mountains, where these species occur even syntopically. A clear exchange of genetic material between the two forms named 'type A' and 'type B' could not be demonstrated. In fact they behave like different species and show a clear preference for

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non-nestmate pupae of their own genetic type in a behavioural choice test (ROSENGREN et al., 1994). Unfortunately, in all these studies cited, no comparative investigations on external morphology of the ants were performed.

The geographic distribution of genetically 'type A like *F. lugubris*' is similar to the distribution of KUTTER's pilosity 'form I' and that of 'type B like *F. lugubris*' is similar to KUTTER's 'form II'. Genetical, behavioural and morphological studies all indicate that these 'types' or 'forms' are in fact different species and it is obvious that only 'type A/form I' can belong to *Formica lugubris* ZETTERSTEDT the locus typicus of which is in Norway. In contrast 'type B/form II' are absent from Fennoscandia and the British Isles and are clearly distinct from *Formica aquilonia.* This close relative of *Formica lugubris* and *F. aquilonia* YARROW, 1955 is described here as the new species *Formica paralugubris* nov. spec. since there is no valid taxonomic name available that refers to this species. This paper will demonstrate that the morphological separation of *F. lugubris* and *paralugubris* nov. spec. is possible even in the more similar workers – a fact which is highly desired in the context of comparative studies of these sibling species.

2. Materials and Methods

2.1. Material

The external morphology was numerically described on the basis of the following material:

Formica lugubris: A total of 197 workers from 42 nest samples; thereof 2 nest samples from the Alps of Central Austria, 7 from Bulgaria (Pirin mountains, Rhodopes), 1 from England (N Yorkshire), 4 from the French Jura, 2 from Germany (Schwarzwald), 1 from Sweden, 1 from N Italy, and 23 nest samples from Switzerland. The latter included 8 genetically typed (type A) nest samples from the study sites of PAMILO et al. (1992) and ROSENGREN et al. (1994) in the Swiss Jura mountains.
A total of 53 queens; 1 from Austria, 3 from Bulgaria, 3 from France and 46 from Switzerland (22 of which were collected in the study sites in the Jura mountains).

Formica paralugubris nov. spec.: A total of 184 workers from 38 nest samples; among them 4 nest samples from the Alps of W Austria, 2 from the French Jura and 32 from Switzerland. The latter included 11 genetically typed (type B) nest samples from the above mentioned study sites in the Swiss Jura mountains.
A total of 49 queens from Switzerland (27 of which were collected in study sites in the Jura mountains).

Formica aquilonia: A total of 116 workers from 23 nest samples; thereof 16 nest samples from the central and W Austrian Alps and 7 nest samples from E Switzerland.
A total of 13 queens; 7 from Finland and 6 from Switzerland.

2.2. Terminology and methods of morphological investigation

All measurements were taken in mounted and dried specimens using a pin-holding device freely turnable into each spatial position. A Wild M10 stereomicroscope equipped with a 1.6× planapochromatic objective was used at magnifications of 80–320×. The maximum possible magnification to keep a structure within the range of the ocular micrometer was used. A mean measuring error of ± 1 µm is given for small and well-defined structures, such as hair length, but may reach 5 µm for large measures with difficult positioning and high dependency from air humidity such as CW. To avoid rounding errors, all measurements have been recorded in µm even for characters where a precision of ± 1 µm is impossible. In order to reduce irritating reflexions of the cuticular surfaces and to get an improved visualization of the microsculpture, a plastic diffusor was positioned as close as possible to the specimen.
If not otherwise stated, statistic tests testing the equality of mean values are: a **t** test when an **F** test proved the equality of the variances; otherwise a modified **t** test with corrected degrees of freedom according to WELCH (1947).

Setae are differentiated from pubescence hairs in having a much larger basal diameter (4–8 µm in setae and 1–2 µm in pubescence). Seta counts (nOCC, nPE, nMET, nMES, nSC) are restricted to standing setae projecting > 10 µm from cuticular surface.

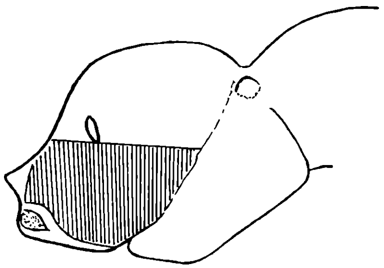

Fig. 1: The reference surface on ventrolateral propodeum and lateral metapleuron where the data of METHL and nMET are taken (hatched area). The margins of the metapleural gland orifice and the ventrolateral edge of metapleuron are excluded.

CL – maximum head (caput) length in median line; the head must be carefully tilted to the position with real maximum.
CW – maximum head (caput) width, which may be across or behind the eyes.
CS – head (caput) size; the arithmetic mean of HL and HW, used as a less variable indicator of body size.
METHL – length of longest standing hair on on lateral metapleuron and ventrolateral propodeum below the level of propodeal spiracle (hatched area in Fig. 1).
mPNHL – mean pronotal hair length in the worker. Applied measuring schedule: select one of the longest hairs on dorsal pronotum and calculate the arithmetic mean length of this hair and of its 6 nearest neighbours.
nMES – number of standing setae on lateral mesopleuron excluding those hairs standing on the ventrolateral edge of mesopleuron.
nMET – number of standing setae on lateral metapleuron and ventrolateral propodeum – i.e. the area below the level of propodeal spiracle but excluding those hairs fringing the metathoracal gland and those standing on the ventrolateral edge of metapleuron (hatched area in Fig. 1).
nOCC – number of standing setae on the occipital margin of head including the postocular head sides. The number refers to one half of the head and counting is performed in the position where CL is measured.
nPE – number of standing setae on the edge of petiolar scale above the opening of the spiracle. The number refers to one half of the petiole.
nSC – number of standing setae on dorsal plane of scape.
PNHL – length of longest standing hair on pronotum in the queens.
SCL – maximum straight line scape length excluding the articular condyle.

In order to obtain a better discrimination of certain morphometric characters, the variation produced by allometries was removed by calculating size-corrected indices. This procedure was necessary to enable a discrimination of the most similar workers of *lugubris* and *paralugubris*.

In the first step, indices of the numeric characters were calculated: CL/CW, SCL/CL, nMET/CS, METHL/CS, nOCC/CS, nPE/CS, nSC/CS, mPNHL/CS. In the second step, linear reggression functions of these indices against CS were calculated for each species separately. This two-step procedure empirically results in a good approximation of allometries by linear functions in all ant groups showing no extreme worker polymorphism (SEIFERT, 1992a; 1992b; own unpublished results).

In discriminant functions this size relation can be considered most effectively if only two species are compared in one calculation. A good fit to the empirical data of the two species under comparison is then provided by a cumulative regression which slope and ordinate intersection are the arithmetic means of the species-specific regressions.

The size-corrected indices CL/CW, nMETcor, METHLcor, nOCCcor, nPEcor, nSCcor, mPNHLcor were then computed by division with the values of these cumulative regression functions. This division means a centering and equal weighting of the corrected indices around the value 1. Compared to the unprocessed primary data, the coefficients of variation are reduced in the size-corrected indices to 65% if there is a strong dependency from body size as given in nMET.

In the last step, the size-corrected indices were incorporated in a multiple linear discriminant function.

Tab. 1: Morphometric data of individual workers of *F. lugubris, paralugubris* and *aquilonia.* Given are the arithmetic mean, the standard deviation and the extreme values. CL/CW_{1750} is a size-corrected head length index which predicts the situation in a sample with all individuals having the same size of CL = 1 750 µm.

	Formica lugubris		***Formica paralugubris***		***Formica aquilonia***	
	(n=197)		(n=184)		(n=116)	
	mean ±SD	[min,max]	mean ±SD	[min,max]	mean ±SD	[min,max]
		[1341,2219]		[1341,2025]		[1288,1935]
CL/CW	1.097 ±0.031	[1.026,1.195]	1.094 ±0.022	[1.041,1.156]	1.107 ±0.020	[1.056,1.159]
SL/CL	0.848 ±0.022	[0.796,0.901]	0.865 ±0.018	[0.815,0.909]		
mPNHL		[63.6,149.5]		[44.6,127.0]		[0,67.9]
nMET		[4,18]		[1,12]		[0,6.5]
METHL		[121,265]		[101,205]		[0,168]
nSC		[0,18]		[0,23]		[0,2.0]
nOCC		[5,40]		[9,39]		[0,21]
CL/CW_{1750}	1.108 ±0.019	[1.063,1.150]	1.094 ±0.018	[1.047,1.140]		

Tab. 2: Distribution of nest sample means of morphometric data of workers of *F. lugubris, paralugubris,* and *aquilonia.* $D_{L/P}$ = 0.53 mPNHLcor + 0.32 METHLcor + 0.20 nMETcor – 0.04 nSCcor and offers a perfect separation of the sibling species *lugubris* and *paralugubris.*

	Formica lugubris		***Formica paralugubris***		***Formica aquilonia***	
	(n=37)		(n=38)		(n=23)	
	mean ±SD	[min,max]	mean ±SD	[min,max]	mean ±SD	[min,max]
		[1439,2062]		[1555,1861]		[1570,1837]
mPNHL		[85.7,121.4]		[67.5,86.9]		[14.9,53.0]
nMET		[6.4,14.2]		[4.1,9.3]		[0.1,4.0]
METHL		[153.8,224.7]		[134.2,171.3]		[15.4,130.8]
nOCC		[15.6,32.0]		[18.2,31.6]		[1.0,12.2]
nSC		[0,12.4]		[0,12.2]		[0,1.2]
mPNHLcor		[0.974,1.320]		[0.751,0.966]		
nMETcor		[0.812,1.454]		[0.443,1.132]		
METHLcor		[0.935,1.336]		[0.836,1.025]		
nSCcor		[0,3.154]		[0,3.693]		
$D_{L/P}$		[1.031,1.339]		[0.711,0.979]		

3. Results

3.1. The numeric separation of *F. paralugubris* from *F. lugubris* and *F. aquilonia*

The separation of *F. paralugubris* from *F. aquilonia* seems to be a minor problem in both workers and queens. At least in the region of the Alps, the number of standing setae on occipital margin of head and the mean length of pronotal setae are very powerful discriminators. Within 23 nest samples of *F. aquilonia* workers, the maxima of nOCC and mPNHL are only 12.2 and 53.0 respectively. In contrast, within 38 nest samples of *paralugubris,* the lower extremes of nOCC and mPNHL are as big as 18.2 and 67.5. In queens, the individual values of nOCC range from 0 to 8 (3.04 ± 2.93) in *aquilonia* and from 9.5 to 39 (23.6 ± 6.0) in *paralugubris.* Additional characters, which may improve the separation, are given in the Tables 1–3.

Tab. 3: Morphometric data of individual queens of *F. lugubris, paralugubris,* and *aquilonia.* Given are the arithmetic mean, the standard deviation, and the extreme values. The discriminant $D_{L/P}$ with $D_{L/P} = 0.109$ METHL + 0.072 MESHL + 0.586 nPE + 0.0011 CW offers a perfect separation of *F. lugubris* and *paralugubris.*

	Formica lugubris		*Formica paralugubris*		*Formica aquilonia*	
	(n=53)		(n=49)		(n=13)	
	mean ±SD	[min,max]	mean ±SD	[min,max]	mean ±SD	[min,max]
CL	2216 ±84	[1946,2396]	2113 ±54	[2006,2268]	2054 ±47	[1974,2123]
CW	2212 ±77	[2013,2411]	2085 ±58	[1978,2245]	2003 ±62	[1872,2098]
CL/CW	1.002 ±0.022	[0.953,1.051]	1.014 ±0.022	[0.973,1.077]	1.026 ±0.022	[0.992,1.068]
SL/CL	0.785 ±0.016	[0.748,0.822]	0.800 ±0.021	[0.761,0.840]	0.799 ±0.029	[0.749,0.868]
PNHL	248.6 ±51.6	[124,330]	86.6 ±49.1	[33,258]	37.1 ±18.4	[0,66]
nPE	19.0 ±4.1	[9.5,28]	8.6 ±3.4	[3,17]	3.9 ±3.8	[0,14]
METHL	306.8 ±35.3	[217,375]	107.6 ±54.4	[32,214]	35.8 ±31.1	[0,108]
MESHL	298.9 ±31.9	[254,384]	137.8 ±64.2	[47,266]	71.1 ±44.1	[0,156]
nOCC	24.9 ±6.1	[14,38]	23.6 ±6.0	[9.5,39]	3.04 ±2.93	[0,8]
$D_{L/P}$	68.5 ±5.9	[56.4,83.6]	29.0 ±10.9	[14.3,51.4]		

More difficult is the distinction of *paralugubris* and *lugubris,* although the statistical difference of all but 2 characters shown in the tables 1–3 is highly significant for $p < 0.0001$. The exceptions are the characters nOCC and CL/CW which are statistically equal in both species. The only character without overlap in the workers is the nest sample mean of mPNHLcor. The most simple application of mPNHL for the species' separation is given in a linear regression:

$$\text{mPNHL} = 0.02477\ \text{CL} + 43.2$$

The mPNHL values of *lugubris* are bigger and those of *paralugubris* smaller than the values indicated by this regression line.

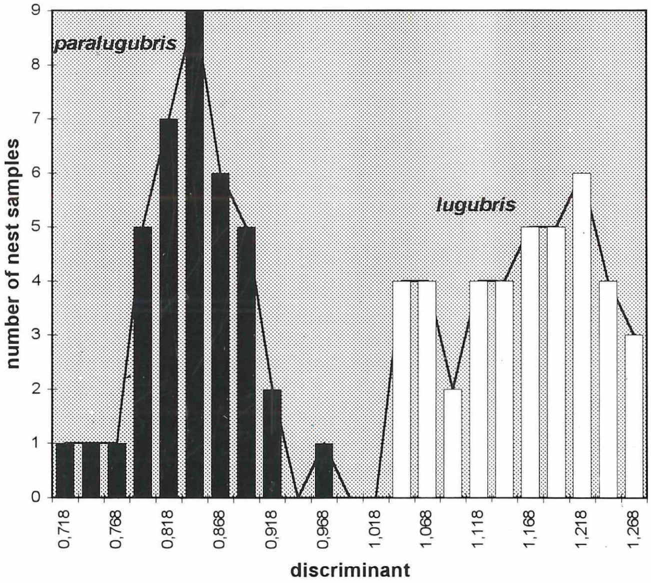

Fig. 2: Frequency distribution of the discriminant $D_{L/P}$ of nest sample means in workers of *Formica paralugubris* nov. spec. and *F. lugubris.*

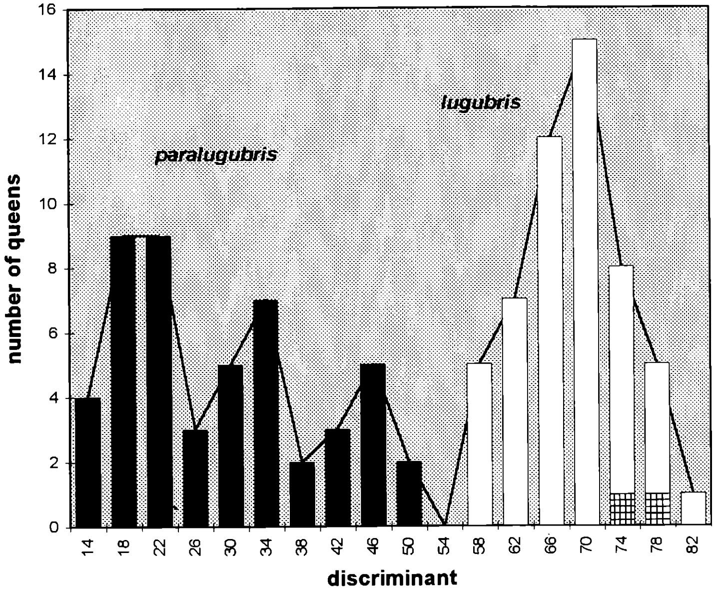

Fig. 3. Frequency distribution of the discriminant $D_{L/P}$ of individual queens of *Formica paralugubris* nov. spec. and *F. lugubris*. The cross-hatched squares within the *F. lugubris* sample represent the type queens of *Formica rufa* var. *nylanderi* Bondroit, 1919.

More powerful and more robust is a multiple discriminant function using 4 characters:

$$D_{L/P} = 0.53\ \mathrm{mPNHL_{cor}} + 0.32\ \mathrm{METHL_{cor}} + 0.20\ \mathrm{nMET_{cor}} - 0.04\ \mathrm{nSC_{cor}}$$

This function thus far offered a perfect separation of all studied samples (Fig. 2). In view of the very few N European and British samples studied, it remains open if this function will be applicable to the *lugubris* population from these regions.

The queens of *paralugubris* and *lugubris* are most clearly separable by METHL, MESHL and nPE (Tab. 3). 36% of the *lugubris* queens have a bigger CW than the largest *paralugubris* queens. A multiple discriminant function:

$$D_{L/P} = 0.109\ \mathrm{METHL} + 0.072\ \mathrm{MESHL} + 0.586\ \mathrm{nPE} + 0.0011\ \mathrm{CW}$$

separated all studied queens (Fig. 3).

3.2. The coincidence of external morphology with genetic and behavioural features

In the material from the Swiss Jura, there is a coincidence of the morphometric determination by means of $D_{L/P}$ with the results of either genetic typing or pupae carrying tests (Pamilo et al., 1992; Rosengren et al., 1994; unpublished results of M. Chapuisat/Lausanne). All 11 nest samples of workers definitely allocated to type B (the nest samples D, G1–G5, G34, G82, R1, R3, R16) had $D_{L/P}$ of 0.74–0.92, which is a clear indication for *Formica paralugubris*. All 8 nest samples definitely allocated to type A (the nest samples G20, G29, G61, G68, GR9, GR12, GR18, GR25) had a $D_{L/P}$ of 1.05–1.27 which is a clear indication for *Formica lugubris*. Another two samples typed by the Lausanne investigators as 'probably type A' (G73 and G29) are clear *Formica lugubris* according to their $D_{L/P}$ of 1.13 and 1.34.

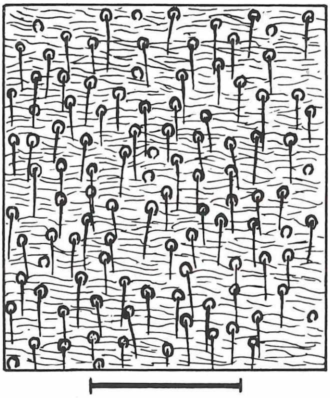

Fig. 4: Microsculpture and pubescence on dorsal plane of first gaster tergite in *Formica paralugubris.* Scale bar = 100 µm.

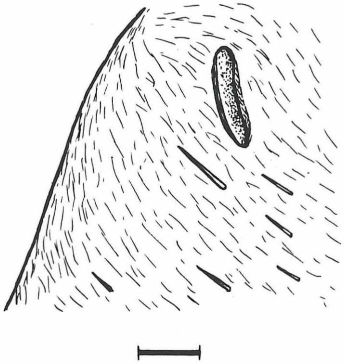

Fig. 5: Typical pilosity condition on the ventrolateral propodeum in the queen of *Formica paralugubris* showing short, straight and thick setae. Scale bar = 100 µm.

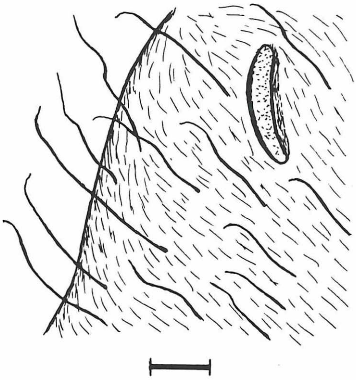

Fig. 6: Typical pilosity condition on the ventrolateral propodeum in the queen of *Formica lugubris* with very long, curved and fine hairs. Scale bar = 100 µm.

3.3. Description of ***Formica paralugubris* nov. spec.**

Type material:
A type series was selected from the nest No. G5 near the Chalet a Roch field station, 5 km SSW Le Brassus in the Swiss Jura mountains. It contains a holotype (a queen) and 10 paratypes (4 queens and 6 workers). The workers were collected on 5 May 1993 and the queens in June 1994. The labelling is “CH: Jura, 5. 5. 1993, Chalet a Roch, nest G5” in the workers and “CH: Jura, 6. 1994, Chalet a Roch, nest G5” in case of queens. Another 24 worker paratypes originate from the nests G1–G4, which belong to the same polycalic nest system as the holotype nest and were collected on 5 May 1993.

Description:

- Queen (Tab. 3, Figs. 4–5): Occipital margin of head with 20–75 erect setae, which are normally 40–80 µm long. Dorsal plane of scape frequently with a number of shorter, semierect setae. Eyes with numerous erect hairs of 22–45 µm length. Standing setae on pronotum, mesonotum, scutellum, lateral mesopleuron, ventrolateral propodeum (Fig. 5), lateral metapleuron, hind tibia, and frontal face of gaster definitely shorter than in *lugubris.* In contrast to this situation, the standing setae on the whole surface of all gaster sternites are very long (250–350 µm). Clypeus more shining than dorsum of head and genae. Mesonotum and scutellum mildly shining, but less than in *rufa.* Dorsum of gaster shining. Dorsum of first gaster tergite with very fine transversal microsculpture and closely set microfoveae of 9–13 µm diameter and 15–30 µm midpoint distance. The microfoveae are the basis for the pubescence hairs (Fig. 4). Median area of clypeus, frontal and occipital parts of head, upper pronotum, mesonotum, scutellum, gaster, and tibiae usually blackish. Genae, underside of head, coxae, femora, lower pronotum, lateral sclerites of mesosoma, and petiole yellowish red. For morphometric data and differences to *lugubris* and *aquilonia* see Tab. 3.

- Worker (Tabs. 1 and 2): Whole surface of head (except of genae), mesosoma, gaster, coxae, femora, and tibiae with numerous erect setae which are on average shorter than in *lugubris.* Dorsal plane of scape frequently with several short and semierect hairs. Eyes with numerous erect hairs the longest of which measure 22–40 µm. Frons of head less matt than in *pratensis,* comparable to situation in *rufa.* Scape shorter and thicker than in *pratensis:* the ratio scape length/maximum midpoint scape diameter is <9.60. Median area of clypeus, frons and back of head, antennae, coxae, femora, tibiae and gaster more or less blackish. Dorsum of promesonotum with a dark patch, which is less well defined than in *pratensis.* Remaining parts of head and mesosoma yellowish red. For morphometric data and distinction from *F. lugubris* see tables 1 and 2.

4. Discussion

There have been described 6 wood ant taxa from the region of the Alps, which should be checked and discussed for a possible synonymy with *Formica paralugubris:*

a) *Formica santschii* WHEELER, 1913: It is a replacement name for invalid name *Formica rufa* var. *alpina* SANTSCHI, 1911, which is a junior homonym of *Formica adamsii* subspec. *alpina* WHEELER, 1909. There are no type specimens available in the WHEELER collection of the Museum of Comparative Zoology in Harvard (STEFAN COVER pers. comm. October 1994). *Formica rufa* var. *alpina* SANTSCHI has been described from the mountains north of Sondrio (Valtellina) in the Alps of N Italy. The only two type workers, which are still available in the collection of the Basel museum, belong to *F. lugubris.* Both have a strongly developed pilosity on the propodeum and metapleuron. The the upper extreme of $nMET_{cor}$ found within all the 184 investigated workers of *F. paralugubris* was 1.319; the type workers of *alpina* had values of 1.284 and 1.624. This should exclude a synonymy with *paralugubris* even if the pronotal and metapleural seta length data of the *alpina* types are less clear. A further indication for a synonymy with *lugubris* is the large CL/CW_{1750} of the type workers: in one specimen it is 1.141 and thus outside the known range of *F. paralugubris.*

b) *Formica rufa* var. *grouvellei* BONDROIT, 1918: An investigation of the type queen (collection of R.I.N.S.B. Brussels) showed that *grouvellei* has nothing to do with the *lugubris-aquilonia* species complex. This type queen shows all structural and morphometric characters which are typical for the hairy morph of *Formica pratensis* RETZIUS, 1783 (= *nigricans* EMERY, 1909, see also SEIFERT, 1992b).

c) *Formica rufa* var. *nylanderi* BONDROIT, 1919: Both existing type queens from the Col de Lautaret/France and from Grindelwald/Switzerland were investigated. They definitely belong to the *lugubris-aquilonia* species complex and show a character combination which is typical for *Formica lugubris* but is strongly deviating from the condition in *paralugubris* nov. spec.: MESHL 339 and 350, METHL 323 and 316, PNHL 283 and 290, nPE 20 and 28 (first number for the type from Grindelwald and the second for the type from Col de Lautaret). The synonymy with *F. lugubris* is obvious.

d) *Formica gaullei* BONDROIT, 1917 and

e) *Formica rufa* var. *rufopratensis* FOREL, 1874. According to the original descriptions (reduction of setae on the eyes) both taxa can not belong to either *lugubris* or *paralugubris* and should be members of the *rufa-polyctena* species complex.

The arguments presented above show that it is a reasonable decision to describe a new species *Formica paralugubris* nov. spec. The external morphology provides no indication that *Formica paralugubris* is more closely related to *Formica aquilonia* than to *Formica lugubris* as suggested by the genetic studies of PAMILO et al. (1992). It is well separable from *Formica lugubris* by external morphology –

at least in the geographical regions where both species are sympatric. The morphological differences demonstrated here are a strong confirmation of the different species identity concluded from genetic and behavioural investigations. The morphological differentiation of the males remains to be studied. *Formica paralugubris* is obviously a very abundant and widespread species in the Jura and central Alps in altitudes between 800 and 2000 m. The known distribution ranges from E France, throughout entire Switzerland to N Italy and W Austria. A syntopic occurrence with *Formica lugubris* was noted for several places in the Swiss and French Jura mountains. *F. paralugubris* is most probably absent in areas north of the Alps, the eastern Alps and the mountain regions of Bulgaria, where only *lugubris* and *aquilonia* are found. There is a rather small sympatric range of *paralugubris* and *aquilonia*. A syntopic occurrence of these species is still not confirmed. Of high interest would be an more detailed investigation of the situation in Graubünden where all 3 species are sympatric.

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References

KUTTER, H. (1967): Variationsstatistische Erhebungen an Weibchen von Formica lugubris Zett. – Mitt. Schweizer. Ent. Ges. **40**: 63–77.

KUTTER, H. (1977): Hymenoptera-Formicidae. Insecta Helvetica **6**: 1–298.

PAMILO, P., CHAUTEMS, D., CHERIX, D. (1992): Genetic differentiation of disjunct populations of the ants *Formica aquilonia* and *Formica lugubris* in Europe. – Ins. Soc. **39**: 15–29.

PASSERA, L., L. KELLER, A. GRIMAL, D. CHAUTEMS, D. CHERIX, D.J.C. FLETCHER, W. FORTELIUS, R. ROSENGREN, E.L. VARGO (1990): Carbohydrats as energy source during the flight of sexuals of the ant *Formica lugubris* (Hymenoptera: Formicidae). – Entomol. Gener. **15**, 1: 25–32.

ROSENGREN, R., D. CHAUTEMS, D. CHERIX, W. FORTELIUS, L. KELLER (1994): Separation of two sympatric sibling species of *Formica* L. ants by a behavioural choice test based on brood discrimination. – Memorabilia Zool. **48**: 237–249.

ROSENGREN, R., D. CHERIX (1981): The Pupa-Carrying Test as a Taxonomic Tool in the *Formica rufa* Group. In: HOWSE, P. E., J.-L. CLEMENT (eds.), Biosystematics of Social Insects (Systematics Association Special Vol. 19, pp. 263–281). Academic Press, London & New York.

SANTSCHI, F. (1911): Une nouvelle variete de *Formica rufa* L. – Bull. Soc. ent. France 1911: 349–350.

SEIFERT, B. (1992a): A taxonomic revision of the Palaearctic members of the ant subgenus *Lasius* s.str. (Hymenoptera: Formicidae). – Abh. Ber. Naturkundemus. Görlitz **66**, 5: 1–67.

SEIFERT, B. (1992b): *Formica nigricans* EMERY, 1909 – an ecomorph of *Formica pratensis* RETZIUS, 1783 (Hymenoptera, Formicidae). – Entomologica Fennica **2**: 217–226.

WALTER, F., D.J.C. FLETCHER, D. CHAUTEMS, D. CHERIX, L. KELLER, W. FRANCKE, W. FORTELIUS, R. ROSENGREN, E.L. VARGO (1993): Identification of the sex pheromone of an ant, *Formica lugubris* (Hymenoptera, Formicidae). – Naturwissenschaften **80**: 30–34.

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