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# Firm evidence for synonymy of Myrmica rugulosoides Forel, 1915 and Myrmica scabrinodis Nylander, 1846

(Nachweis der Synonymie von Myrmica rugulosoides Forel, 1915 und Myrmica scabrinodis Nylander, 1846)

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with 2 tables and 2 figures

## Introduction

Although there is a general trend in the post-war myrmecology to suppress the taxon *Myrmica rugulosoides* Forel, 1915, some authors have argued for its existence (PETAL 1963, BARONI URBANI 1971, KUTTER 1977). Alleged morphological arguments for *M. rugulosoides* are differences in male genitalia (PETAL 1963), smaller size of workers, weaker sculpture, brighter colour or sharper angle between upper and frontal surface of petiole in lateral view (KUTTER 1977 and others). BARONI URBANI (1971) writes simply that *rugulosoides* differs from *scabrinodis* "per numerosi caratteri ecologici ed etologici e per l'habitus generale" without stating which characters these are.

In short, the opposing party (SADIL 1951, PISARSKI 1975, COLLINGWOOD 1979) states that these characters are to much variable to have any discriminating value. However, the opponents as well as the advocates have never tried to verify their opinions by statistic examinations. The impression I gained, after having seen many thousands of workers and dozens of males and queens, was that there seems to exist not a single morphological character which could serve for separating *scabrinodis* and *"rugulosoides"*. The only argument on which the advocates of *"rugulosoides"* are in agreement (regarding morphology they are contradictory in part) is the assumption of a perfect ecological seggregation: *"M. rugulosoides"* is said to be restricted to wet *Sphagnum* bogs and *M. scabrinodis*, on the other side, should inhabit dry habitats. For I did not know any way how to separate both forms by morphology I have investigated samples from wet peat bogs alone (moisture figures according ELLENBERG 1979 ranging from 8.6 to 9.0) and, on the other side, samples from dry habitats

exclusively (moisture figures 3.3–4.5). Samples from intermediate environments, like for instance fresh meadows, were excluded from comparison to avoid a possible confusion of *"rugulosoides"* with *scabrinodis* characters, if the ecological hypothesis should be true.

## Material

All material of this study was collected in the southern half of the GDR. In queens and males I have seen much other examples, but in these the habitat origin was not clear.

Workers

— Wet peat bogs (phytoassociations clearly dominated by *Sphagnum*): 72 individuals of 11 nest samples from localities near Weißwasser and Hoyerswerda (both district Dresden, 160 m above sea level) and Carlsfeld (distr. Karl-Marx-Stadt, 930 m a. s. l.),

— Dry habitats (grasslands, sunexposed wood margins, way sides): 90 individuals of 13 nest samples from Sondershausen (distr. Erfurt), Ballenstedt, Bilzingsleben, Heldrungen (all distr. Halle), Görlitz, Schönau-Berzdorf, Löbau (all distr. Dresden), and Schmölln (distr. Leipzig).

Queens

— Wet peat bogs:

15 individuals from 10 nests from the above mentioned sites.

— Dry habitats:

7 examples from five nests from Meisdorf (distr. Halle), Ilsenburg (distr. Magdeburg), Heldrungen, Löbau, and Görlitz.

Males

— Wet peat bogs:

14 examples from 4 nests from Weißwasser.

— Dry habitats:

7 examples from 3 nests from Ilsenburg, Heldrungen und Schönau-Berzdorf.

## Results

Workers

In each individual nine measurements were made: head length in median line (HL), head width across eyes (HW), minimal frons width (FR), maximum distance of frontal lobes (FL), scape length (SL), propodeal spine length (SP), petiole width (PE), post-petiole width (PP), and the angle between anterior and dorsal faces of petiole (PA). All measurements are recorded in micron, although such accuracy is normally not achieved, to minimize rounding errors. The petiole angle was measured by projection of the microscopic picture on a goniometer. From these measurements were computed twelve characters which are given in Tab. 1. In the column "all habitats" are added two nest samples from a salty moist meadow near Hecklingen/distr. Magdeburg.

Table 1

| | wet peat bogs (n = 72) | | dry habitats (n = 90) | | all habitats (n = 178) | |
|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | mean | SD |
| FL/FR | 1.411 | 0.0602 | 1.372 | 0.0434 | 1.389 | 0.0540 |
| HW/FR | 3.088 | 0.1386 | 3.037 | 0.1072 | 3.062 | 0.1220 |
| SL/HL | 0.783 | 0.0156 | 0.778 | 0.0160 | 0.780 | 0.0162 |
| PP/HW | 0.412 | 0.0118 | 0.408 | 0.0153 | 0.408 | 0.0153 |
| PE/HW | 0.287 | 0.0125 | 0.284 | 0.0129 | 0.284 | 0.0130 |
| PA | 85.87 | 5.62 | 86.02 | 5.16 | 85.90 | 5.30 |
| HL | 1063.5 | 57.46 | 1045.8 | 60.23 | 1056.9 | 59.21 |
| HW | 1023.9 | 58.70 | 1010.9 | 57.74 | 1020.0 | 58.40 |
| SL | 832.8 | 41.03 | 813.2 | 44.10 | 824.0 | 43.27 |
| PE | 293.9 | 21.64 | 287.2 | 21.29 | 289.9 | 21.23 |
| PP | 422.3 | 27.90 | 411.5 | 31.49 | 416.1 | 29.50 |
| SP | 375.4 | 32.25 | 367.6 | 38.99 | 371.1 | 35.82 |

A glance at Table 1 shows that the mean values of all characters are nearly equal in samples from *"rugulosoides"* and *"scabrinodis"* habitats. The t-test proves equality of the mean values for $p < 0.01$. The ratio FL/FR and SL alone are significantly different for $p < 0.001$ and $< 0.01$ respectively. It is notable that just the body size of the peat bog population of this samples seems to be larger than in dry habitat populations what disproves the statement that these should be smaller. Furthermore the data give no evidence that another alleged difference, the smaller PA of peat bog populations, is existing. In two workers from Marais sur Roche/Switzerland, leg. VIEHMEYER 24. 8. 1919, which were labelled apparently by FOREL himself as paratypes (first description 1915!) one has a PA of 70° and the other of 93°, a variability that is possible within nests from all habitats. The pigmentation argument was not tested, but I frequently observed in *Sphagnum* bogs nests with very light coloured workers closely neighboured with nests having very dark workers. Few centimeters distant from each other, the environmental conditions of these nests can be regarded as equal what implicates that these colour differences have a genetic basis. In a xerothermous grassland where I chanced to find several nests I made similar observations. Furthermore nests of uniform intermediate colour were found as well as nests containing dark and light coloured workers what indicates that pigmentation can never serve as discriminating character.

Since the comparison of 12 characters one by one shows no remarkable morphological distance between the two populations, it might be asked whether we could get a better separation by a multiple discriminant analysis. For this purpose I have calculated for all individuals a determinant using the method described in the previous paper of this journal (SEIFERT 1984). I have taken into calculation one absolute measurement (HL) and the four relative characters FL/FR, HW/FR, SL/HL, and PP/HW which are hoped to give some separation. The determinants are

for wet peat bogs $D = 0.0888 \pm 0.1510$ $(n = 72)$ and
for dry habitats $D = -0.0631 \pm 0.1119$ $(n = 90)$

expressed in mean and standard deviation. Although the discriminating power of this multiple test is high we find only 11,7 % of the total individuals outside

of the overlap range. This is not sufficient to indicate a separate taxonomic identity of both populations. For comparison, this multiple method results in a perfect discrimination of 95 % of all *Myrmica sabuleti* and *scabrinodis* workers, 100 % of all *M. vandeli* Bondr. and *scabrinodis* workers, or 100 % of all *M. specioides* Bondr. and *M. rugulosa* Nyl. workers which all are species pairs of high morphological similarity (unpublished results). The t-test and the non-parametric MANN-WHITNEY-test both indicate a highly significant ($p < 0.001$) difference of the determinant means of bog and dry habitat populations, but this should not be seen as argument for separate species identity because it is a normal situation that this multiple analysis demonstrates significant differences between populations of the same species.

Queens

In this caste as well as in males the number of investigated individuals was restricted by the lack of material which could be savely attributed to dry habitats. However, the statistic basis may be accepted since the dry habitat examples originate from five different localities. Table 2 gives the data for 8 characters measured in the queens. All characters are equal for $p < 0.01$ according the MANN-WHITNEY-test or the t-test. This proves the results obtained in workers.

Table 2

| | wet peat bogs (n = 15) | | dry habitats (n = 7) | | all habitats (n = 23) | |
|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | mean | SD |
| FL FR | 1.337 | 0.0404 | 1.316 | 0.0506 | 1.329 | 0.0430 |
| HW FR | 2.941 | 0.0743 | 2.944 | 0.0789 | 2.943 | 0.0723 |
| SL HL | 0.748 | 0.0151 | 0.731 | 0.0212 | 0.744 | 0.0193 |
| PE HW | 0.316 | 0.0093 | 0.307 | 0.0236 | 0.313 | 0.0155 |
| PP HW | 0.473 | 0.0197 | 0.464 | 0.0210 | 0.470 | 0.0198 |
| HL | 1235.5 | 27.54 | 1214.6 | 56.70 | 1224.2 | 44.20 |
| HW | 1238.1 | 34.76 | 1212.1 | 55.30 | 1226.7 | 44.41 |
| SP | 401.1 | 30.15 | 415.1 | 41.4 | 405.5 | 33.8 |

Males

Although having examined a total of 34 males from 10 localities, the statistical basis for a morphometric comparison of wet peat bog and dry habitat populations is not sufficient. From the first group were available only examples from the one bog near Weißwasser and from the second group only males from three localities in which just the one nest with a subaverage scape length and body size made up 4 of the total of 7 males. So I omit this useless comparison and restrict the consideration on genitalia.

KUTTER (1965) has discussed the statements of PETAL (1963) and came to controversial findings regarding the stipes, volsella, lacinia, and the basal tip of the subgenital plate. He found in his one type male of *rugulosoides* those characters that PETAL designated as *scabrinodis* characters and in his one (?) male of *scabrinodis* exactly PETALs "*rugulosoides*" characters. From study of the four Weißwasser nest series I can confirm that the above mentioned parts of

genitalia show, even within the same nest, an extreme variability having typical *"scabrinodis"* and typical *"rugulosoides"* types as well as all degrees of intermediates. In fact, these characters are useless for discrimination. I believe the widespread opinion of many taxonomists that the male genitalia should always be a very constant, distinctive structure with highest importance for species separation is an inadmissible generalization. This fashionable opinion was perhaps the reason why PETAL and KUTTER thought that the examination of single or very few individuals should be sufficient.

In one criterion KUTTER agrees with PETAL: His type male of *rugulosoides* had only one large, shallow indentation at each side of the subgenital plate (see the first and second drawings in Fig. 2) whereas its *scabrinodis* male had two smaller indentations (see the third and fourth drawing in Fig. 2 or the first drawing in Fig. 1). I can clearly state that this alleged difference has never any value. A look at Fig. 1 illustrates which variability is possible within

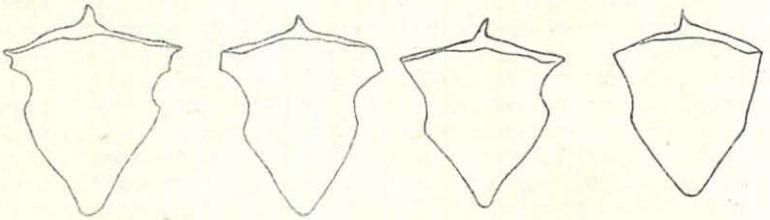

Fig. 1

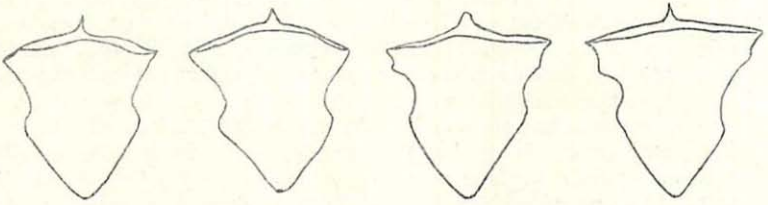

Fig. 2

Fig. 1. Variability of the subgenital plate within one population of a wet Sphagnum plot in a peat bog near Weißwasser/distr. Dresden. The left drawing shows the „scabrinodis" shape and the two right drawings „rugulosoides".

Fig. 2. Variability of the subgenital plate within one nest from a dry way side near Heldrungen/distr Halle. The two left drawings show „rugulosoides" characters and the two right drawings „scabrinodis" characters.

one *Sphagnum* bog population and Fig. 2 shows the four subgenital plates from one dry habitat nest having two typical *"rugulosoides"* and two typical *"scabrinodis"*.

Summing up, I conclude that in all three castes no serious hint for separate species identity was detectable and the taxon *M. rugulosoides* Forel, 1915 is to be abolished.

**Remarks on ecology of Myrmica scabrinodis Nyl.**

*M. scabrinodis* is a rather thermophilous species having a T-value of 24.7 °C. For comparison, the T-value of *M. laevinodis* is 19.3 °C, of *M. ruginodis* 19.1 °C. or of *M. specioides* 29.3 °C. A paper explaining what this T-value means and how it is measured is in preparation. *M. scabrinodis* has a high tolerance against humidity differences. In this respect it surpasses clearly all other Central European *Myrmica* species, except *ruginodis* and *laevinodis* which are similar or slightly more tolerant and perhaps *vandeli* of which I have no data. *M. scabrinodis* is the absolutely dominating ant, in densities up to 109 nests/ 100 m², in those parts of peat bogs where at least 80 % of the surface is covered by *Sphagnum* which produces favourable temperature conditions. It vanishes in those parts of bogs where higher vegetation generates to much shaddow and decreases soil surface temperatures. There it is replaced by *laevinodis*, mostly in lowland bogs, and by *ruginodis*, particularly in highland bogs. *M. scabrinodis* is really rare in xerothermous grasslands where it has been frequently confused with *sabuleti* which is often the dominating *Myrmica* species in such habitats. Most of the literature records for occurrence of *scabrinodis* in dry habitats are misidentifications. *M. scabrinodis* is absent from habitats having moisture figures below 3.2. Within a system of 97 test plots distributed all over the southern part of the GDR the probability to occur in places having moisture figures between 3.2 and 4.3 was only 1 % and, on the other side, the probability for occurrence in habitats having moisture figures between 6.4 and 9.0 was appr. 98 % assuming equal frequencies or equal "supply" of dry and wet habitats along the gradient. This illustrates the difficulty to get dry habitat material. The mean moisture figure was computed as 8.0. The mean plant density value of moss and field layer plants for the habitats inhabited by *scabrinodis* was 1300 meaning, e. g., a layer of 13 cm mean height multiplicated with its cover of 100 %. Comparison values are for example: *specioides* 636, *sabuleti* 1108, *ruginodis* 1976, *laevinodis* 2908. It should be noted that we have in Central Europe, along the Alpes and up to the 53th degree northern latitude, with *M. vandeli* Bondr. a species which shares the peculiar wet-peat-bog-preference of *M. scabrinodis*. Workers of both species are easily confused by the eye but are separable with security using a multiple discriminant analysis. In three peat bogs in Czechoslovakia (leg. P. WERNER) and in Baden-Württemberg/FRG (leg. MÜNCH) *vandeli* was observed in coexistence with *scabrinodis*.

**Abstract**

It is shown that *Myrmica rugulosoides* Forel, 1915 is a synonym of *Myrmica scabrinodis* Nylander, 1846. The comparison of 10 morphological characters of 162 workers from 24 nests and of 22 queens from 15 nests originating from different localities in the southern GDR resulted in firm evidence that dry habitat population (= *M. scabrinodis)* are not different from wet peat bog populations which are alleged to be *"M. rugulosoides"*. A multiple discriminant test of high power produced very insufficient separation of workers with only 11,7 % of all individuals falling outside the overlap range. Regarding the male genitalia, perfect *"rugulosoides"* characters are associated with perfect *"scabrinodis"* characters in the same nest and all kinds of intermediates occur indicating that the alleged genitalia differences are useless.

**Zusammenfassung**

Es wird gezeigt, daß *Myrmica rugulosoides* Forel, 1915 ein Synonym von *Myrmica scabrinodis* Nylander, 1846 ist. Der Vergleich von 10 morphologischen Merkmalen an 162 Arbeitern aus 24 Nestern und an 22 Königinnen aus 15 Nestern von verschiedenen Orten der südlichen DDR erbrachte einen festen Beweis, daß sich Populationen von Trockenhabitaten (= *M. scabrinodis)* nicht von solchen von nassen Torfmooren, die angeblich nur *„M. rugulosoides"* sein sollen, unterscheiden. Eine multiple Diskriminanzanalyse von hoher Trennschärfe ergab mit nur 11,7 % außerhalb des Überlappungsbereiches fallenden Individuen eine sehr unzureichende Trennung der Arbeiter. Den männlichen Genitalapparat betreffend fanden sich im gleichen Nest typische *„scabrinodis"* zusammen mit typischen *„rugulosoides"* und alle Abstufungen von Intermediärformen, was beweist, daß auch die angeblichen Genitalunterschiede wertlos sind.

**Literature**

BARONI URBANI, C. (1971): Catalogo delle specie di Formicidae d'Italia. Mem. Soc. Ent. Ital. 50: 30; COLLINGWOOD, C. (1979): The Formicidae of Fennoskandia and Denmark. Fauna Entomologica Skandinavica 8. Klampenborg; ELLENBERG, H. (1979): Zeigerwerte der Gefäßpflanzen Mitteleuropas. Scripta Geobotanica 9. Göttingen; FOREL, A. (1915): Die Ameisen der Schweiz. Mitt. Schw. Ent. Ges. **XII**, 7/8: 29; KUTTER, H. (1965): Miscellanea myrmecologica III. Mitt. Schw. Ent. Ges. 37/3: 127–130; KUTTER, H. (1977): Hymenoptera-Formicidae. Fauna Insecta Helvetica 6: 45–68; NYLANDER, W. (1846): Adnotationes in monographiam formicarum borealium Europae. Acta Soc. Sci. Fenn. T. **II**: 930; PETAL, J. (1963): Donnees pour la morphologie de Myrmica rugulosoides Forel et Leptothorax nigescens Ruzsky. Bull. Accad. Pol. Sc. Varsovie, Ser. Sc. Biol., T **XI**, 8: 379–382; PISARSKI, B. (1975): Mrowki-Formicoidea, Katalog Fauny Polski 26/1, Warszawa; SEIFERT, B. (1984): Nachweis einer im Freiland aufgetretenen Bastardisierung von Leptothorax nigriceps Mayr und Leptothorax unifasciatus (Latr.) mittels einer multiplen Diskriminanzanalyse. Abh. Ber. Naturkundemuseum Görlitz 58, 7.

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