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The taxonomical and ecological status of Lasius myops FOREL (Hymenoptera, Formicidae) and first description of its males

(Die taxonomische und ökologische Stellung von Lasius myops FOREL mit Erstbeschreibung seiner Männchen)

by BERNHARD SEIFERT

with 9 figures

1. Introduction

In the course of investigations of ants belonging to the *Lasius flavus* group collected from xerothermous habitats the author encountered two morphologically clearly different forms, a small-eyed form which was ascribed to *Lasius myops FOREL*, and another form with considerably larger eyes regarded as *Lasius flavus* (FABRICIUS).

The taxonomic status of *Lasius (Cautolasius) myops* has always been the subject of doubtful and controversial statements in the myrmecological literature since the original description of the worker in 1894 and of the queen in 1915 in both cases by FOREL. The transitional forms *Lasius flavus* v. *flavoides* and v. *flavo-myops* described by FOREL further increased the confusion in the determination of ants belonging to the *Lasius flavus* group. The historical development of the discussion of this issue is briefly outlined in the following section.

VIEHMEYER (1915) was the first to state the assumption that the occurence of the varieties *flavo-myops* and *flavoides* was due to deficient feeding conditions since both forms live in very dry and poor environments unproductive for „aphid breeding". He suggested that these adverse conditions explained the weakly developed polymorphism of workers and low number of alates which he regarded to be indistinquishable from those of *L. flavus*. VAN BOVEN (1951) demonstrated in *L. flavus* that the reduction of ommatidia numbers clearly follows an allometric trend. With these findings he claimed (VAN BOVEN 1977) that there was no reason to give *L. myops* a separate taxonomic status. The measurements of VAN BOVEN (1951, 1977) are the only precise investigations on the relation of ommatidia numbers to other body measurements in *L. flavus.* They are, however, in spite of the large number of individuals examined of no value for the finding of a taxonomic decision because the material was collected only from very few nests and, in addition, did not belong to small-eyed forms. WILSON (1955) reconstituted VIEHMEYERs food deficiency theory, took into account the findings of VAN BOVEN (1951), adjudged *L. myops* to have no subspecies rank and synonymised it with *L. flavus* on the basis of only two alleged lectotypes of FOREL. The error regarding the types was cleared up by KUTTER (1977) who examined the real type series of FOREL which still exists in the Lausanne Zoological Museum and consists of 14 equally small individuals, each with only 15–20 ommatidia per eye. BARONI URBANI (1971) synonymised *L. myops* with *L. flavus* without giving an explanation for this interpretation. COLLINGWOOD (1971) assessing the taxonomic status of *L. myops* followed the conception of WILSON and noted, in addition, the occurence of „large brown macroergate workers in cool climates" in *L. flavus.* Contrary to all above mentioned authors KUTTER (1977) was willing to believe *L. myops* to be a good species, but suggested that the status of this form was still controversial without giving sufficient explanation. In the same paper he also pointed out features for the differentiation of *L. myops* from *L. flavus* and synonymised the varieties *L. flavus* v. *flavoides* and v. *flavo-myops.*

The above account, without claiming to be a complete history, indicates that a lot of statements have been made on the *L. myops* problem which were all based on insufficient investigations. This illustrates the necessity of bringing more clarity into this problem. In this paper firm evidence is given for regarding *L. myops* as a good species, that there are detectable significant morphological differences even in the case of close neighbourhood of the two, meaning that both species live in reproductively isolated populations even where they occur sympatrically. *L. flavus* has extraordinary ecological importance in many of the habitats where it is found, and *L. myops,* although as a whole very much rarer, may reach comparable high densities in some xerothermous grasslands. Both species, considered together, are ants for which exact distinction is regarded as highly necessary in the context of ecological studies.

2. Results

2.1. Workers

The *L. myops* material included 21 nest series with 172 workers from seven localities (Quedlinburg, Weddersleben, Meisdorf, Ditfurt, Balgstädt, Zscheiplitz, Günserode) in the district Halle/GDR.

Additionally five nest series from five southern palaearctic sites were evaluated:

Obsor/Bulgaria, leg. LIPPOLD 1979	8 workers
Tirnovo/Bulgaria, coll. VIEHMEYER	16 workers
Evenla Encantada/Spain, leg. COLLINGWOOD 1976	2 workers
Tarragona, Sierra de Prados/Spain, leg. COLLINGWOOD 1976	4 workers
Terni, prov. Oran/Algeria, leg. FOREL (Zoological Museum Berlin, probably syntypes)	7 workers

From this material a total of 26 nest series with 209 workers from 12 localities was investigated statistically.

The evaluated material of *L. flavus* was collected by the author in the GDR in the years 1979–1982 and contained 27 nest series from 9 localities with 219 specimens (sites: Quedlinburg, Weddersleben, Ditfurt, Balgstädt, Zscheiplitz, Friedrichsaue – all district Halle; Görlitz, Meißen, Hagenwerder – all district Dresden). Five of the collecting sites in the district Halle were situated at the same places where *L. myops* was taken, in three cases in closely neighboured test plots and in two cases at the same test plots with equal habitats. The concentration of the morphological investigation on specimens from xerothermous grasslands had the aim of studying as much as possible direct comparison material from similar or, in few cases, equal environments.

Additionally *L. flavus* workers were examined from approximately 450 nests from 26 other test plots including 23 grasslands of very different temperature and humidity conditions, soil type and mode of management, one *Sphagnum* bog and two pine forests. This material was not taken into statistical evaluation because time consuming serial measurements were not possible, but only tests at random were made with single individuals. All these specimens ware clearly determined to be *L. flavus* following the determinant feature pointed out in the paper.

For the statistical distinction of workers of both species ommatidia number per eye in relation to maximum head width was used. All visibly protruding ommatidia were counted including the smaller, apparently light marginal ones. The head width was measured with a 10/100 ocular micrometer in a SM XX stereomicroscope (Carl Zeiss Jena), at magnifications between 62 and 200.

Results of measurements of 424 workers of both species are given in the following table.

		ommatidia number		head width in micron	
	n	range	mean SD	range	mean SD
L. myops	209	6 – 42	18.95 ± 6.81	540 – 1002	696.2 ± 88.5
L. flavus	219	12 – 105	44.17 ± 13.31	500 – 1198	769.8 ± 116.4

All single values are depicted in fig. 1. Out of 424 examined individuals in about 23 cases a random choice of one will be doubtful as to which species distribution it belongs. This means that approximately 5 % of single individuals could not be determined if they would have been collected alone. Although within each species there are detectable variations in the relation ommatidia number as function of head width between the different nests, all measured nest series could clearly be matched either to the distribution of *L. flavus* or that of *L. myops* by investigation of five specimens. Both distributions proved to be different for any considered head width even at highest significance levels ($p = 0.0005$) if tested for equality of their mean values in a onesided combined F-t test. A look at fig. 2 illustrates that for equal head widths *L. flavus* has on average double the ommatidia number than *L. myops*.

The values can be well described by the following linear regression functions:

L. flavus $N = 100.47\,x - 33.17$ $(n = 219, r_{xN} = 87.9\,\%)$
L. myops $N = 68.46\,x - 28.27$ $(n = 209, r_{xN} = 88.9\,\%)$

where N = number of ommatidia per eye, x = value of head width in millimeters, and r_{xN} = linear correlation coefficient.

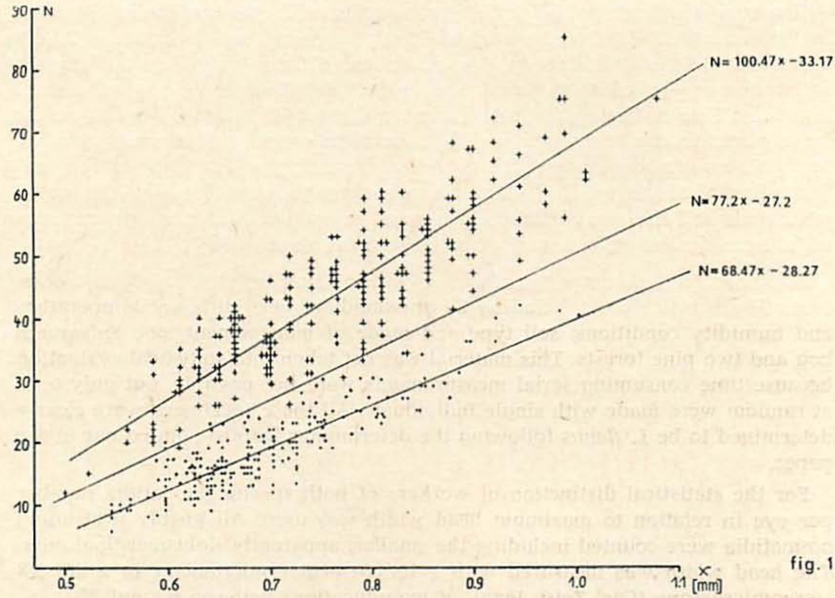


Fig. 1. Ommatidia numbers of 205 workers of *Lasius myops* (small dots) and of 219 workers of *Lasius flavus* (crosses) plotted against head width given in millimeters.

As a simplification for determination may be used the rule:

L. flavus $N > 77.2\,x - 27.2$ and

L. myops $N < 77.2\,x - 27.2$.

If applying this key to the whole examined material two individuals of *L. myops* and six of *L. flavus* would be misidentified meaning an error of 1.9 %. Although in the vast majority of cases the study of only two individuals per nest should suffice, examination of more examples may be necessary in some cases to come to a clear decision. The differentiation mark pointed out by KUTTER (1977) that the head width is 6–6.5 times larger than the eye length in *L. flavus* and more than 8 times in *L. myops* was tested at random and proved to be useful. Nevertheless this index should be changed to 6–7.2 in *L. flavus* and more than 7.2 in *L. myops*. However, the determination following this key mark seems to be less accurate than counting the ommatidia. It must be emphasized there that the absolute ommatidia numbers given in KUTTERs key are unsuitable without reference to other body measurements.

Most of the material used for the statistical morphological evaluation was taken from on average very similar environments. Therefore a certain probability exists that the significantly smaller mean head width of *L. myops* compared to *L. flavus* is a difference occuring independently of environmental conditions.

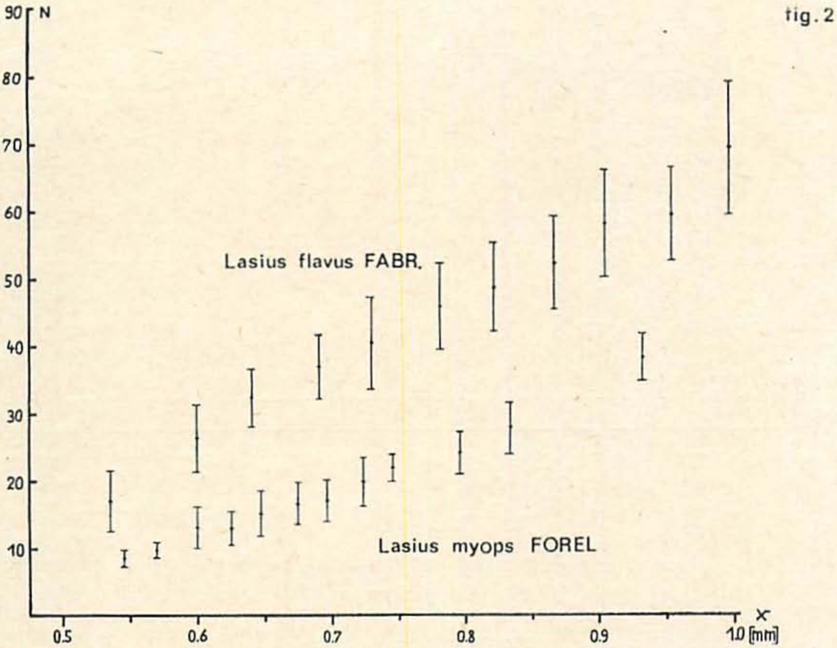


Fig. 2. Mean values with standard deviations of ommatidia numbers plotted against the corresponding mean head width. The mean values for each interval were calculated from at least 6 measurements and countings.

It is obvious that all sites in which both species lived in close neighbourhood the above mentioned morphological differences were detectable, even if they inhabited the same test plot and consequently practically equal environments. Therefore one can assume two genetically different populations maintaining constant differences even under sympatric, closely neighboured occurence, and thus under conditions of high potential probability for mutual exchange of genetic material. The existence of reproductive isolation is consequently very probable. For this reason *L. myops* should be regarded as a stabilised species. The morphological investigations on the sexual castes shown in following sections supply a strong confirmation of this opinion.

In this context the probable reason why the majority of authors were not able to recognise *L. myops* to be a separate taxon can be explained as follows. Within the species *L. flavus* exists an even subjectively easily visible decrease of the body measurements, and thus also of the eye size, along a gradient of increasing environmental temperatures and decreasing humidity and productivity of the habitats. While the percentage of dark and large workers with ommatidia numbers of about 90 is high in humid, cool, and productive meadows such individuals are very rare in warm, dry, and poor habitats. Macroergate workers from productive environments may have a head width of 1.20 mm with corresponding ommatidia numbers of 105. Though not tested statistically

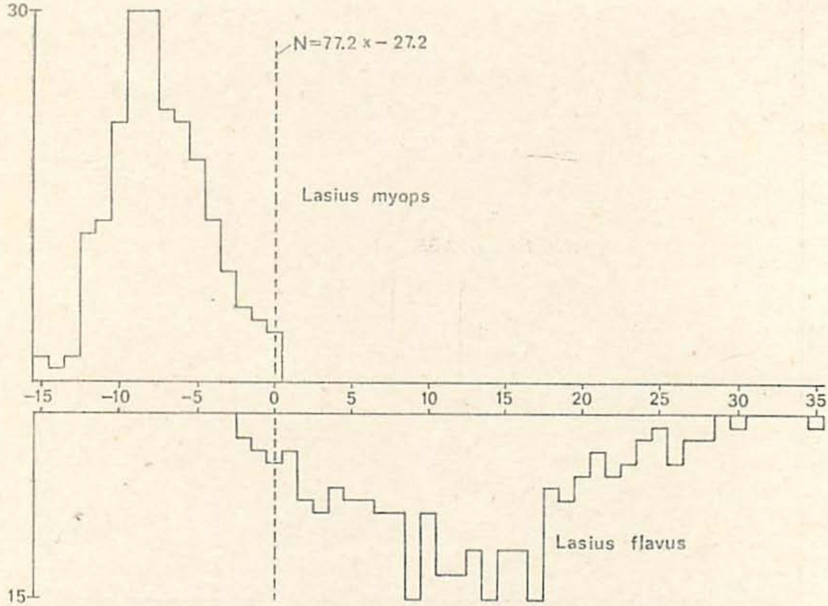


Fig. 3. Difference of ommatidia numbers of workers in relation to values calculated by the determinant function N = 77.2 x — 27.2. Note the small overlap range.

the ommatidia number seems to change gradually with the alteration of environmental factors. There is consequently no reason to nominate the small-eyed populations of *L. flavus* as a subspecies. The use of the names *L. f. flavoides* or *L. f. flavo-myops* should therefore be abolished. Workers of nest series in the Zoological Museum Berlin collected by VIEHMEYER and labeled by himself with these names were all typical *L. flavus*.

Since most of the material examined was collected in a rather restricted geographical region of Central Europe it would be of much interest to hear from similar studies from other parts of the continent. The 37 workers of *L. myops* from Bulgaria, Spain, and Algeria matched the values obtained from Central European material very well. This can be regarded as a suggestion for general applicability of the relations presented here.

Though the above mentioned key marks alone should enable accurate determination, other morphological characters were considered. The uniform pale yellowish colour (only the largest workers are slightly darker) is of doubtful value for a distinction from *L. flavus*. Actually the latter is on average darker than equal sized *L. myops*, but in xerothermous grasslands nests with ligth yellowish individuals are to be found regularly. Differences in pubescence and pilosity were not detectable.

2.2. Queens

Alltogether 26 queens of *L. myops* were examined:

2 queens from Tirnovo/Bulgaria, with males and workers coll. VIEHMEYER, Zoological Museum Berlin;
1 queen from Weigersdorf, district Dresden/GDR, leg. JORDAN 22. 7. 1963;
20 queens from two different nests with males and workers from Zscheiplitz, 4 km W Freyburg, district Halle/GDR, leg. SEIFERT 8. 9. 1981;
1 single queen from Balgstädt, 5 km SW Freyburg, leg. SEIFERT 30. 8. 1981;
2 queens with males and workers from Günserode, 6 km SW Bad Frankenhausen, district Halle/GDR, leg. SEIFERT 9. 9. 1981;

29 queens of *L. flavus* originated from 12 localities in the southern GDR belonging to the districts Halle, Erfurt, Leipzig, Dresden – among them 4 queens labeled by VIEHMEYER as v. *flavo-myops*.

The separation of both species in this caste is difficult. The medium eye diameter (mean of the short and the long diameter of the elliptic eye) in relation to head width is significantly smaller in *L. myops* queens than in *L. flavus* with ratios of 19.87 $\pm$ 0.44 % and 21.07 $\pm$ 0.58 % respectively but nearly 50 % of all specimens are found in the overlap range and much care in measuring is needed. In this study eye diameters were taken at a magnification of 200 enabling an accuracy of nearly one micron. The regression lines of mean eye diameter (y) against head width (x) in micrometers were computed for

L. flavus $y = 0.20535\,x + 7.693$ ($r_{xy} = 0.8377$, $n = 29$) and for

L. myops $y = 0.21067\,x - 18.302$ ($r_{xy} = 0.7609$, $n = 26$).

Significantly different ($p = 0.001$) but of very doubtful reliability for determination purposes is the head width of both species. Results of the morphometric investigations are shown in the following table in which the abbreviations mean: HW = maximum head width, HL = maximum head length in median line, mE = medium eye diameter = mean of long and short diameter.

	L. myops				*L. flavus*			
	range	mean	SD	n	range	mean	SD	n
HW	1471–1632	1535.5	36.9	26	1337–1640	1455.4	63.8	29
$\frac{HL}{HW}$	0.825–0.894	0.870	0.015	23	0.849–0.939	0.878	0.020	24
mE	284–320	305.2	10.2	26	280–351.5	306.6	15.7	29
$\frac{mE}{HW}$ [%]	19.3–20.4	19.87	0.44	26	19.7–21.9	21.07	0.58	29

The pigmentation pattern of head offers the most reliable means for discrimination. Of course this character can not be applied savely to newly hatched young queens with unfinished pigmentation or very old bleached specimens and much care is needed to prevent misleading illumination effects. The figs. 4 and 5 show the differences in the distribution of the dark brown pigment on head in lateral view. In *L. myops* the posterior underside of head is always paler than the posterior upperside of head or the pronotum. In *L. flavus* no remarkable differences in intensity of pigmentation are observed on these body parts. In both species the scale shape shows considerable variation (see figs. 4 and 5). If there exists a difference at all the scale in *L. flavus* tends to have more angled upper corners which are in *L. myops* more rounded.

2.3. M a l e s (with first description of males of *L. myops)*

L. m y o p s

Material – alltogether 36 individuals from 5 different nests:

25 males from three nests from Zscheiplitz, 4 km W Freyburg, district Halle/GDR. leg. LIPPOLD and SEIFERT 1980/1981;
5 males from Günserode, 6 km SW Bad Frankenhausen, district Halle/GDR, leg. SEIFERT 1981;
6 males from Tirnovo/Bulgaria, coll. VIEHMEYER.

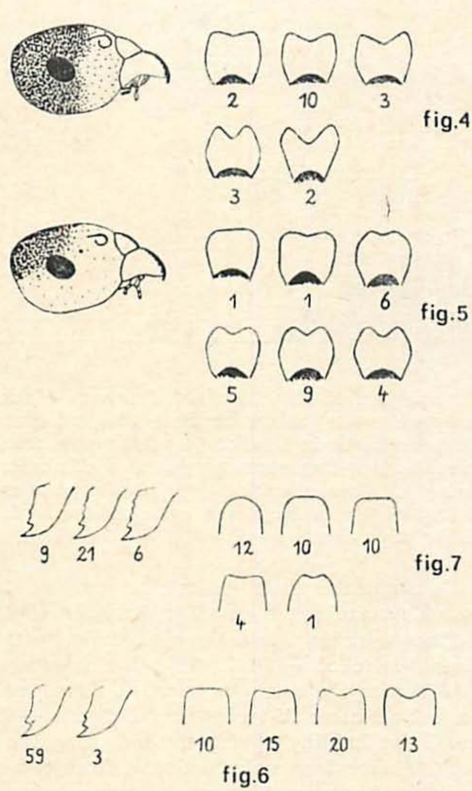
All males were collected together with worker series. Thus their belonging to *L. myops* is sure. The VIEHMEYER series is deposited in the Zoological Museum Berlin and all other material in the Görlitz Natural History Museum.

L. f l a v u s

62 specimens from 20 Central European sites (mainly from the GDR) and 4 individuals from Dobrostan/Bulgarian Rhodopy Mountains, leg. SEIFERT, were examined.

The most certain means for the separation of both species in this caste is the mandibular dentition. In *L. myops* the masticatory border of mandibles typically carries one to three more or less pronounced smaller denticles in addition to the larger apical and subapical teeth. 6 males carried one denticle, 21 two, and 9 males three denticles. In sharp contrast in *L. flavus* only three out of 62 examined males had one such small denticle, but all others none (see figs. 6 and 7), and a perfectly smooth masticatory border after the subapical tooth. Differences exist also in scale shape. In *L. myops* the upper margin of scale (see fig. 6) is in one third of the studied examples more or less rounded, in about 55 % of the examples flat with sometimes well marked corners, but in only 12 % very slightly notched. In the opposite in 88 % of the *L. flavus* males the upper scale margin was more or less remarkably notched (see fig. 7), in about 12 % of the examples it was perfectly flat, and in no one of the 62 males it was rounded like in many *L. myops* males. The following table gives measurements and indices of both species in micron. The abbreviations mean: maE = maximum eye length, MW = maximum mesonotal width before the tegulae, SW = maximum scale width half-way above the stigma, N = number of small denticles posterior of the subapical tooth of mandible, SL = scape length, and HW = maximum head width across eyes.

	L. myops				*L. flavus*			
	range	mean	SD	n	range	mean	SD	n
maE	215–258	237.6	14.2	13	229–295	261.1	19.8	18
HW	652–860	767.2	48.6	34	664–866	777.2	51.9	28
SL	416–546	486.9	20.2	15	410–607	501.7	61.6	10
$\frac{SL}{HW}$	.599–0.671	0.635	0.025	15	.556–0.758	0.654	0.072	10
MW	667–967	855.5	81.0	35	700–956	844.3	63.0	28
SW	202–304	248.1	26.2	34	228–337	278.0	26.5	26
$\frac{SW}{HW}$	.278–0.395	0.324	0.028	33	.281–0.433	0.352	0.029	27
$\frac{SW}{MW}$	.247–0.326	0.291	0.020	34	.289–0.379	0.324	0.023	27
$\frac{HW}{MW}$	.771–1.005	0.897	0.055	34	.843–1.032	0.923	0.047	26
N	1–3	2.08	0.67	36	0–1	0.048	0.047	62



Figs. 4–7. Fig. 4 – queen of *Lasius flavus:* distribution of dark brown and yellowish pigments of head in lateral view and variability of scale shape in posterior view; the numbers below each drawing indicate the number of observed cases.

Fig. 5 – the same for *Lasius myops* queen.

Fig. 6 – male of *Lasius flavus:* variability of mandibular dentition and of scale shape in posterior view; the numbers below each drawing indicate the numbers of observed cases.

Fig. 7 – the same for *L. myops* male.

The indices HW/MW, SW/HW, and SW/MW proved to be significantly different if tested in a onesided combined F-t test for error probabilities of 0.05, 0.005, and 0.005 respectively.

34 males of *L. myops* and 26 males of *L. flavus* were subjected to a trivariate analysis using the morphological features mandibular dentition, SW/HW, and SW/MW. The analysis which methodical basis will be described elsewhere (SEIFERT in preparation) gave a good discrimination with small overlap (see

fig. 8

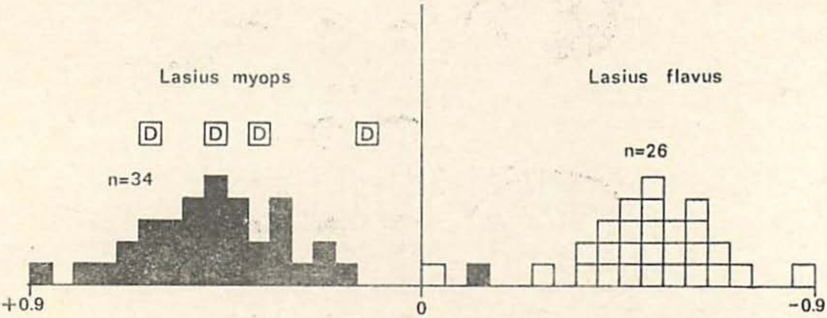


Fig. 8. Trivariate analysis of the males of *L. myops* (dark squares) and *L. flavus* (empty squares) using the morphological characters mandibular dentition, scale width in relation to head width across eyes, and scale width in relation to maximum mesonotal width before the tegulae. We have good separation except the four puzzling males from Dobrostan/ Bulgaria (squares with D). These were collected from two nests with typical *L. flavus* workers.

fig. 8). Positive discriminant values indicate a complex *L. myops* character whereas negative values indicate a complex character of *L. flavus.* Only one *L. myops* of the Tirnovo series would be misidentified with this method, having a discriminant value of — 0.107. All other specimens range between + 0.175 and + 0.870. For the most untypical *L. flavus* male is computed a value of — 0.006, but all other 25 males vary between — 0.357 and — 0.887. However, a general applicability of this method using the above mentioned characters is doubtful since four males collected from two nests with typical *L. flavus* workers in the Bulgarian Rhodopy Mountains were computed to have values between + 0.175 and + 0.611. The scale shape of these aberrant specimens showed the typical *flavus* character but all had one additional dent on the mandibles.

2.4. The ecological position of both species

As already known from the literature (e. g. STITZ 1939, NIELSEN 1977) *L. flavus* represents an ecologically extremely eurypotent type. The author found *L. flavus* to inhabite an extraordinary wide scale of very different habitats ranging from extremely hot and dry xerothermous grasslands to wet *Sphagnum* bogs or mires, and including sparse pine forests with developed field layer. In contrast *L. myops* proved to be a very stenopotent type found exclusively in very xerothermous grassland habitats with on the average less developed field layer.

The ecological study which included 93 test plots was made to investigate comparatively the habitat demands of about 40 ant species in the southern half of the GDR and was not specially aimed at the *L. flavus-myops* problem. Details of the methods used in this survey and a discussion of their applicability or possible errors can not be given in this paper. This should be published elsewhere after having finished the whole investigation programme. Among others three habitat factors where determined for each test plot:

T – The soil temperature 3.5 cm beneath the surface, during a typical cloudless summer day with a macroclimatic air temperature minimum of 13 °C before sunrise and a maximum of 25 °C two hours after passage of the meridian. The „radiation summer" means the period from beginning of May to mid August.

H – The soil humidity adjusted by observing the richness, density, and especially species composition (indicator plants!) of the plant cover on the test plot, supplemented by observations on other factors like wind exposure and sun exposure, situation in the relief, and soil type, if plant indication is not sufficient. Nine soil moisture classes were compiled beginning with class 1 meaning an extremely dry soil (e. g. exposed hill tops of sand dunes) and ending with extremely humid habitats like for instance the wettest parts of Sphagnetum phytoassociations in bogs (class 9). Of course this method is affected by the possibility of subjective misjudgements but a clear advantage is that plant cover represents a kind of „long time memory" for environmental conditions.

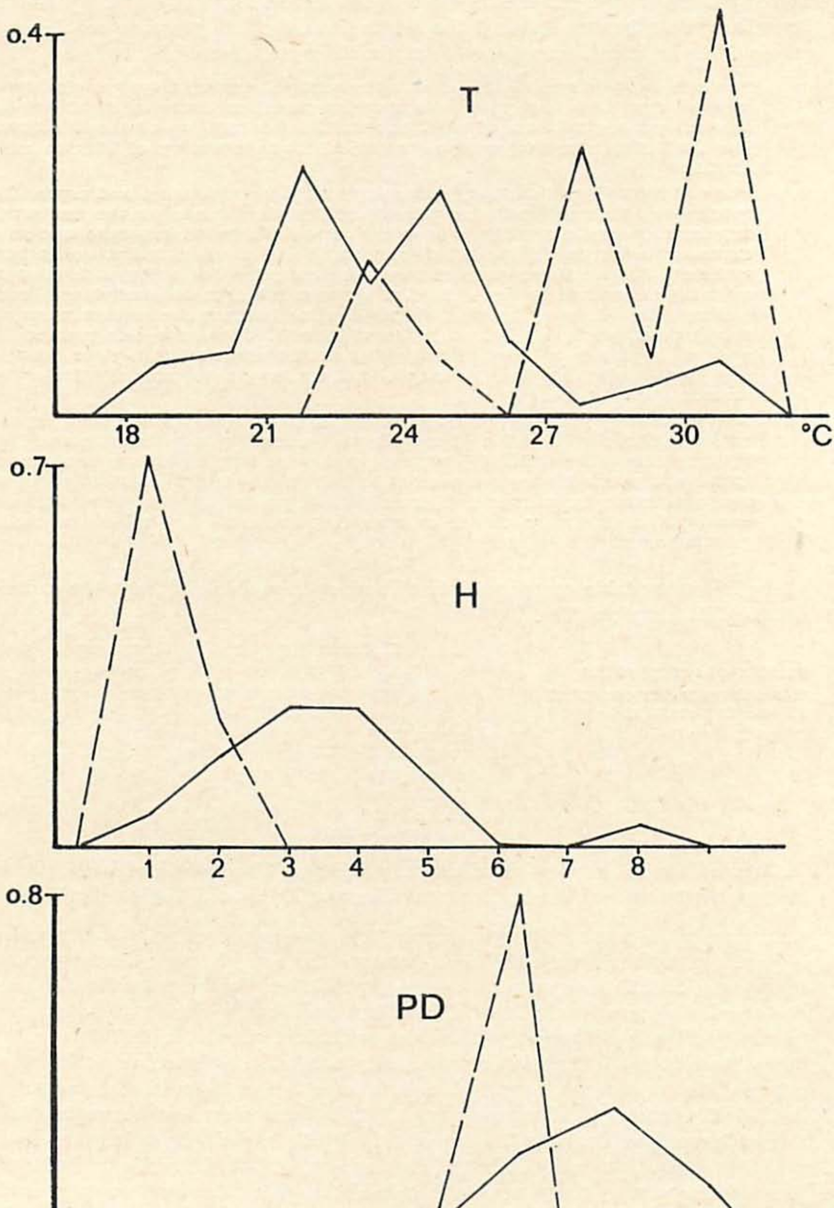
PD – The phytodensity of the field and, if existing, moss and lower bush layers calculated by multiplication of mean cover percentage with mean height. For instance a meadow with 100 % covering and mean height of 15 cm is adjusted to have a plant density value of 1500. These values can be regarded as a rough estimate for overground green plant biomass. Of course the time of examination should be chosen as near as possible to the end of the main growth period.

The following table compares data of both species obtained from the examination of 93 test plots (TP).

	L. flavus	*L. myops*
number of occupied TP	39 (41.9 %)	8 (8.6 %)
mean density per occupied TP (nests per 100 m²)	35.7	10.3
T in °C	mean 23.6 range 17.0 – 31.5	mean 28.2 range 23.7 – 31.5
H	mean 3.39 range 1 – 8	mean 1.28 range 1 – 2
PD	mean 1154 range 60 – 2500	mean 779 range 180 – 1000

A more detailed impression of the very different distribution of both species along the gradients of the environmental factors T, H, and PD gives fig. 9.

Obviously the most weighty factor for ecological segregation of both species is provided by their very different demands for soil moisture. *L. myops* was exclusively found in dry or extremely dry habitats. In the opposite *L. flavus* preferred moderate humidity conditions, but could occur even in wet Sphagnetalia phytostands of bogs if there exist some host plants for aphids. On the other hand, it did not avoid extremely dry habitats. In respect of soil temperature *L. flavus* shows a remarkable preference to the temperature range 21.1 to 25.4 °C where 69 % of all nests were found. The coolest habitat was a shady riverside meadow having a T-value of only 17 °C. In such places large mounds are always built to enable a better development of broods, while mound construction is actually very rare in hot habitats where this species may reach rather high densities up to 30 nests per 100 m². *L. myops* was not detected in test plots with T-values below 23.7 °C which shows its pronounced thermofig. 9



o.4
T
18
21
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27
30
°C
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H
1
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7
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PD
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4oo
65o
1ooo
16oo
25oo

philism. The fact that *L. myops* was observed in test plots with on the average lower phytodensity than *L. flavus* is probably no real difference in preference behaviour regarding this variable but only a result of differing physico-chemical environment. It is noteworthy that the differences in mesoclimatic demands of both species are confirmed by considering the macroclimatic situation. All test plots with *L. myops* were situated in localities of the district Halle with annual rainfall of 470–520 mm and mean July temperatures of 17–19 °C. In contrast, no *L. myops* but only *L. flavus* were found on study areas in the district Dresden which all have an annual rainfall of 600–700 mm but similar July temperatures. This supports the above mentioned opinion that humidity is the most segregating factor.

The fact that both species coexisted in only two of the 45 occupied test plots indicates that an equilibrium between them is built up only under rare conditions and may suggest to strong competition often finding its expression in perfect exclusion of one of the species. In regions where large areas are absolutely dominated by *L. flavus* and only small areas with extremely xerothermous habitats are present the stenopotent *L. myops* may be competed out frequently through the strong population pressure of its eurypotent relative, even if these small places should have a very suitable mesoclimate. Probably this is the case in the district Dresden and in a lesser extent in parts of the district Halle where *L. myops* is ousted to the most extreme places with very sparse vegetation cover having densities no higher than 6 nests/100 m^2. On the opposite a strong population exists on the large xerothermous grasslands of limestone regions in some Thuringian parts of the district Halle. There *L. myops* is able to compete out *L. flavus* even in habitats with more developed field layer and may reach densities up to 30 nests/100 m^2. *Lasius flavus* was observed to have the highest densities on meadow plots at the margin of arable land in agricultural regions with high soil fertility. Densities of approximately 100 nests/100 m^2 were stated there repeatedly. The top value of 108.5 lies surely near the limit of maximal possible abundance. However such densities make difficulties in detecting the accurate number of nests because these are often hardly separable from each other.

3. Summary

In this paper firm evidence is given for regarding *Lasius myops* FOREL as a good species different from *Lasius flavus* (FABRICIUS). The study revealed constant morphological differences of the two species even under closely neighboured sympatric occurence. The most easy separation is possible in the worker caste where *L. myops* has aproximately half the ommatidia number of *L. flavus* for equal head widths. Absolute ommatidia numbers are unsuitable for determination purposes in many cases since the smallest *L. flavus* workers may have only 12 ommatidia per eye while for largest *L. myops* workers were

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Fig. 9. Distribution of *Lasius myops* (interrupted line) and *Lasius flavus* (solid line) nest sites along a gradient of increasing soil temperature (T), soil humidity (H), and phytodensity (PD). The ordinate indicates probabilities. For further explanations see text.

counted up to 42. The best character to separate the queens of both species is the distribution of dark brown pigmentation on the head. The males of *L. myops* which are described in this paper for the first time are well characterized by the masticatory border of their mandibles which shows at least one small dent in addition to the larger apical and subapical teeth. In contrast the occurence of such a small denticle is a rare exception in *L. flavus* (only 5 % of all examined specimens).

Comparative ecological investigations on 45 test plots in very different habitats which were occupied by at least one of the two species demonstrate that both are segregated ecologically. *L. myops* is a very stenopotent type found exclusively in warm, dry and oligotrophic habitats. In contrast *L. flavus* is a clearly eurypotent type preferring sites of moderate temperature and humidity conditions and higher phytodensity, without avoiding habitats typical for *L. myops*.

Zusammenfassung

Die vorliegende Arbeit zeigt auf, daß *Lasius myops* FOREL als eine von *Lasius flavus* (FABR.) verschiedene Art zu betrachten ist. Die Untersuchung erbrachte konstante morphologische Unterschiede beider Arten, die auch bei eng benachbartem sympatrischem Vorkommen feststellbar sind. Die leichteste Unterscheidung gelingt in der Arbeiterkaste, wo *L. myops* für gleiche Kopfbreiten nur die Hälfte der Ommatidienzahl von *L. flavus* besitzt. Absolute Ommatidienzahlen sind für Bestimmungszwecke häufig ungeeignet, da kleinste Arbeiter von *L. flavus* nur 12 und größte Arbeiter von *L. myops* bis zu 42 Ommatidien pro Auge besitzen können. Das beste Kennzeichen zur Unterscheidung der Königinnen ist die Verteilung des dunkelbraunen Pigmentes auf dem Kopf. Die Männchen von *L. myops*, die hier das erste Mal beschrieben werden, sind stets sehr gut dadurch gekennzeichnet, daß der Kaurand ihrer Mandibeln zusätzlich zu den größeren apikalen und subapikalen Zähnen noch mindestens ein weiteres, kleines Zähnchen besitzt. Ein derartiges Zähnchen wird bei *L. flavus* nur ausnahmsweise beobachtet (etwa 5 % aller Fälle).

Vergleichende ökologische Untersuchungen auf 45 Kontrollflächen, die von mindestens einer der beiden Arten besetzt waren, in sehr unterschiedlichen Habitaten zeigten eine deutliche ökologische Trennung. *L. myops* ist ein sehr stenopotenter Typ, der ausschließlich in warmen, trockenen und oligotrophen Habitaten gefunden wird. Dagegen ist *L. flavus* ein stark eurypotenter Typ, der Orte mit gemäßigten Temperatur- und Feuchtigkeitsbedingungen und hoher Pflanzendichte bevorzugt, ohne Habitate zu meiden, die typisch für *L. myops* sind.

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