Entomol. Gener.	10(2): 065–075	Stuttgart 1985-05	ISSN: 0171-8177

EGT-Nr 456 I

Life History and Male Morphology of the Workerless Parasitic Ant Epimyrma corsica (Hymenoptera: Formicidae)

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Received: 1984-06-18/1984-09-28 Accepted: 1984-10-04

Buschinger, A., [Inst. Zool., Techn. Univ.; D-6100 Darmstadt] & Winter, U. [Dep. Biol., Univ.; D-2800 Bremen]: **Life History and Male Morphology of the Workerless Parasitic Ant Epimyrma corsica (Hymenoptera: Formicidae).** – Entomol. Gener. **10**(2): 065–075; Stuttgart 1985. – [Article].

Epimyrma corsica (Emery 1895), known up till present by only 1 dealate ♀, was rediscovered in the island of Corsica (France), and in Yugoslavia. The host species is *Leptothorax exilis* Emery 1869. No *Epimyrma* workers were found in a total of 62 field collected colonies, and none were produced in laboratory culture. The *Epimyrma* ♂♀ mate inside their mother nests, thus exercising a continuous inbreeding. Young queens shed off their wings and hibernate within the mother nest which they leave in spring in order to invade new host species colonies. During colony foundation the *E. corsica* queen throttles the host colony queen to death, as is usual in that genus. In case of a successful invasion she is accepted by the adult host species ☿☿. *E. corsica* is the first truly workerless *Epimyrma* species, and it seems to represent the last instar in an evolutionary series leading from a slavemaker biology [e g *E. ravouxi* (André 1896)] to a derived kind of permanent parasitism. – The *E. corsica* ♂ is described.

Buschinger, A., & Winter, U. [Inst. Zool., FB Biol., Techn. Hochschule; D-6100 Darmstadt, and FB 2 (Biologie), Univ.; D-2800 Bremen]: **Lebensweise und Männchen-Morphologie der arbeiterinnenlosen, parasitischen Ameise Epimyrma corsica (Hymenoptera: Formicidae).** – Entomol. Gener. **10**(2): 065–075; Stuttgart 1985. – [Abhandlung].

Epimyrma corsica (Emery 1895), bisher nur in Form eines einzigen entflügelten ♀ bekannt, wurde auf der Insel Korsika (Frankreich) sowie in Jugoslawien wiedergefunden. Die Wirtsart ist *Leptothorax exilis* Emery 1869. Insgesamt 62 im Freiland gesammelte Völker enthielten keine *Epimyrma*-☿☿, auch in Laborhaltung wurden keine produziert. Die *Epimyrma*-♂♀ kopulieren im Mutternest und betreiben somit kontinuierlich Inzucht. Die Jungköniginnen entflügeln sich und überwintern im Mutternest, das sie erst im Frühjahr verlassen, um neue Wirtsvölker aufzusuchen. Während der Koloniegründung tötet die *E. corsica*-Königin die Wirtskönigin durch Würgen am Hals, wie es in dieser Gattung üblich ist. Wenn die Koloniegründung erfolgreich verläuft, wird die parasitische Königin von den adulten Wirts-☿☿ akzeptiert. *E. corsica* ist die 1. wirklich ☿☿-lose *Epimyrma*-Species, und sie scheint die Endstufe einer Evolutionsreihe darzustellen, die von einer Sklavenhalter-Lebensweise [z B *E. ravouxi* (André 1896)] zu einer abgeleiteten Form des permanenten Parasitismus führt. – Das *E. corsica* ♂ wird beschrieben.

0171-8177/85/0010-0065 $ 2.75

1 Introduction

Epimyrma corsica was the first species of this genus though originally described by Emery [1895] under the name *Formicoxenus corsicus*. Together with *Formicoxenus ravouxi* André (1896), Emery [1915] transferred the species into his newly established genus *Epimyrma*. Meanwhile 12 *Epimyrma* species have been described [Kutter 1973, Espadaler 1982], one of which, *E. goesswaldi* Menozzi 1931 had to be synonymized with *E. ravouxi* [Buschinger 1982]. This species, and also *E. stumperi* Kutter 1950 exhibit a truly dulotic behavior [Winter 1979 and unpubl.]. *E. kraussei* Emery 1915 has a reduced number of ♀♀ and is able to conduct slave raids only exceptionally [Buschinger & Winter 1983, Winter & Buschinger 1983]. *E. vandeli* Santschi 1927 was said to be workerless, however, in laboratory culture our colonies from the type locality have produced a few *Epimyrma* workers (unpubl.).

Only the holotype specimen, a dealate ♀, was known from *E. corsica* up till recently. It is deposited in the Museo Civico di Storia Naturale "Giacomo Doria" in Genova, Italy. The label indicates "Corsica, Revelière", which means that it was collected somewhere in the island of Corsica by Eugène Revelière. Via the collection de Saulcy it has come into Emery's hands. Neither the host species nor a more precise locality were known; the indication "Corse: Bonifacio (Emery)" in Bernard [1968] appears to lack any foundation.

2 The rediscovery of Epimyrma corsica

Among the papers of the late entomologist Dr Walter Faber from Vienna, we found some notes on an *Epimyrma* species which he had collected several times between 1967 and 1972 in the Dalmatian island Krk, near Baška. The host species was *Leptothorax exilis*, and the altogether 5 colonies did not contain any *Epimyrma* ♀♀. The ♀♀ were well corresponding with the description of *E. corsica*. Kutter [1973] mentioned this Dalmatian population as "*E. corsica* Em. from Krk", however, only in a figure caption. He had received the material from W. Faber.

In 1981-09-23/26, we collected a total of 24 colonies of this species in the localities where Faber had found them, in the island of Krk. An additional 15 colonies were collected in 1983-09-26/10-03, in the vicinity of Zadar (Yugoslavia) near Biograd, Ljubac, and Jesenice. In 1982-03-21/31, we were collecting systematically around the island of Corsica, and we finally found a population of *E. corsica* in an area named "Désert des Agriates" (between l'Ile Rousse and St. Florent), near the Col de Lavezzo. A total of 18 colonies were collected there, and a direct comparison with the holotype specimen revealed that the new material really represented this species.

The populations from Krk and Zadar exhibit only slight differences to that from Corsica. Mainly the ♀♀ from Yugoslavia are a little bit larger than those from Corsica (total length holotype: 2.38 mm, other ♀♀ from Corsica: 2.37 mm, 2.42 mm, 2.51 mm; 19 ♀♀ from Krk: 2.61 – 2.75 – 2.88 mm), and the thorax of the ♀♀ from Corsica is even more flat than in ♀♀ from Yugoslavia. The latter also appear a little bit more robust. Tab 1 contains some comparative measurements. In both areas we found a considerable number of ♀♀ with fusions of antennal segments (Fig 1). Seven out of 20 ♀♀ from Yugoslavia, and 2 of 15 from Corsica exhibit this peculiarity. Usually the antennal segments no 5 and 6 (scapus = segment 1) are partially fused, but in one ♀ from Corsica it is segment 8 and 9. Fusion of antennal segments frequently occurs also in ♂♂ (see section 4). Our field studies and the results of laboratory breeding of part of the colonies yielded the material for the following life history of *E. corsica*. We also include a description of the yet undescribed males.

Tab 1: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – comparison of ♀♀ from Corsica and Yugoslavia. All dimensions in mm.

Locality	Caput		Thorax		Scapus	Petiolus		Postpetiolus	
	length	width	length	width	length	height	width	height	width
Corsica Holotype ♀	0.60	0.48	0.73	0.40	0.37	0.34	0.17	0.25	0.24
Corsica $♀_1$	0.59	0.48	0.73	0.40	0.39	0.29	0.16	0.24	0.24
Corsica $♀_2$	0.60	0.48	0.71	0.40	0.36	0.32	0.16	0.25	0.23
Corsica $♀_3$	0.63	0.51	0.80	0.45	0.40	0.33	0.18	0.27	0.27
Krk $♀_1$	0.67	0.53	0.87	0.49	0.40	0.33	0.17	0.29	0.27
Krk $♀_2$	0.67	0.51	0.83	0.51	0.41	0.33	0.18	0.28	0.29
Krk $♀_3$	0.63	0.47	0.80	0.47	0.43	0.33	0.16	0.27	0.27

3 The life history of Epimyrma corsica

3.1: The locality of our population in Corsica is situated in about 420 m NN, a few meters N of the road no D81 in the Col de Lavezzo. The very stony to rocky area is covered by a macchia of about 1–2 m height. Colonies were found preferably in places with a not too dense vegetation cover. The nests of the host species as well as those parasitized by *Epimyrma* are located within the crevices of rocks or between small slabs lying atop each other. Usually they extend over only a few cm^2, and they contain, like in most Leptothoracini, but a few dozen up to several hundred individuals. In the island of Krk the colonies were found within dry meadows which are used as pastures only sporadically. The nests were situated preferably in the crevices of some rocky outcrops rising above the surface of the surrounding vegetation. Near Zadar, we found a few nests, again in rock crevices, in open karst areas with a very sparse low vegetation. At Ljubac a somewhat larger population was living in the clefts of a SE exposed rocky slope.

3.2: The host species in all places was identified as being *Leptothorax exilis*. Several subspecies and varieties of this species have been described, however, Baroni Urbani [1971] synonymized them all under the name of the polytypical species *L. exilis*. Whilst the ☿☿ from Corsica all appear uniformly black, the *exilis* colonies from Yugoslavia often contain several lighter, sometimes nearly yellow, specimens.

3.3: No E. corsica ☿☿ have been found in a total of 62 field collected colonies (including the five colonies of W. Faber). Six colonies from Krk, and 10 from Corsica, have been kept in laboratory culture for at least one breeding season. They produced numerous ♂♀, but no ☿☿ of the parasitic species (Tab 2, 3 and section 3.4).

3.4: The production of sexuals was estimated both from colonies, which were collected in the field during fall, and from laboratory bred colonies.

Tab 2 contains the results of a census which was made just after collecting (Yugoslavia, 1983-09-26/10-03). The number of ♀♀, mostly dealate, but some still alate or even in the pupal instar, by far exceeds that of the ♂♂. Since we suggest that only intranidal mating takes place (see below), it may surprise that 9 of the 14 colonies did not contain any ♂.

Tab 2: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – Field collected colonies from Yugoslavia (1983-09-26/10-03). The number of ♀♀ should usually include one old queen per colony, this, however, was not checked by dissection.

Col. no.	♀♀ (♀ pupae)	♂♂ (♂ pupae)	host species ☿☿
1	1	–	11
2	3	1	52
3	7	(1)	57
4	9	–	56
5	12 + (1)	–	22
6	13	–	56
7	14	–	17
8	16	–	19
9	17	2	4
10	21 + (2)	–	152
11	23 + (2)	–	2
12	42 + (1)	–	21
13	44	13	37
14	46	1	12
Σ 14	274	18	518

We suppose that part of the ♂♂ may already have died after having inseminated most of the ♀♀ in these colonies.

A sample of 6 colonies, which were collected in 1981-09-23/26, in Krk, contained a total of 81 ♀♀ and 10 ♂♂. At least one ♂ was present in each colony except for one which did not contain any young ♂♀. In a following breeding period in the laboratory, after an artificial hibernation of 6 months in a constant 10 °C, the six colonies produced a total of at least 41 ♀♀ and 4 ♂♂. A similar sample of 10 colonies from Corsica (collected in 1982-03-21/31, after a natural hibernation), with a much higher number of host species ☿☿, yielded a total of 347 ♀♀ and 29 ♂♂ in laboratory culture. In both samples several ♂♂ and ♀♀ may have died or have been devoured before censuses were made, the actual production therefore might have been somewhat higher.

However, what we surely may conclude from these results is the fact that in *E. corsica*, both from the type area and from Yugoslavia, only very few ♂♂ are produced. The relations are presented in Tab 3 for comparison.

Tab 3: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – Production of ♂♂ and ♀♀ in colonies from different localities, field and laboratory data.

Locality	Field/Lab	n col.	Production of ♀♀	♂♂	n♂/♀
Corsica	lab	10	347	29	0.083
Krk	field	6	81	10	0.123
Krk	lab (Faber)	1	88	8	0.091
Krk	lab	6	41	4	0.097
Zadar	field	14	274	18	0.073
Σ		37	831	69	0.083

3.5: Mating of the ♂♀ obviously takes place within the mother nests. In the fall, 1981, we have observed several times the mating attempts of ♂♂ just after the colonies had been aspirated into the collecting vials. Mating attempts were also frequently seen in laboratory colonies when the nests were uncovered and the inhabitants exposed to light. However, these attempts were unsuccessful, and we never saw the actual mating behavior, neither in the field, nor in laboratory culture. The following data, nevertheless, prove that mating takes place within the nests.
Only a small fraction of the available ♀♀ have been dissected, since a considerable number of them was needed for colony foundation experiments. Dissections were carried out as described by Buschinger & Alloway [1978]. The following results were obtained:

a) One colony from Krk, collected on 1981-09-24, contained 7 dealate ♀♀. All of them were newly inseminated, their ovarioles being short and without visible eggs or corpora lutea.
b) One colony from Corsica, collected on 1982-03-28, contained 8 dealate ♀♀. Two of them were inseminated, and had medium-sized ovarioles containing corpora lutea (polygyny? – see discussion). Five ♀♀ were inseminated but had short and transparent ovarioles. One specimen was not properly dissected.
c) After one breeding period in laboratory culture a total of 6 dealate and 1 alate ♀♀ were taken from three colonies which had been collected in 1982-03, in Corsica. All the females had hatched in the laboratory, and they had been staying within their mother nests, together with males, until they were dissected on 1982-08-27. The alate ♀ was not inseminated, and also were 3 of the dealate ♀♀. The remaining 3 dealate ♀♀ were inseminated and had short, transparent ovarioles, as those in the field samples a and b.

From these observations, and from the fact that numerous dealate ♀♀ are present in the colonies in fall (September/October in Yugoslavia), and still a few in spring (end of March, Corsica), we conclude that mating takes place within the mother nests, and that the fertilized young ♀♀ remain there over winter.

3.6: The colony foundation of *E. corsica* apparently begins in early spring. Whilst we did not find any recently founded colony during our collecting in fall, in Yugoslavia, and nearly all the colonies (37 out of 39) contained young ♂♀, we detected a number of incipient colonies in Corsica in spring. Among a total of 18 colonies which were collected in 1982-03-21/31, we have found:

a) 2 colonies with 1 *Epimyrma* ♀, and 1 *Leptothorax exilis* ♀ each. In both cases the typical throttling behavior of the *Epimyrma* ♀♀ was observed, and the host colony ♀♀ died soon after.
b) 1 colony with 2 *Epimyrma* ♀♀, 1 of which was seen throttling the *Leptothorax* ♀ of the colony. Another colony even contained 3 dealate *Epimyrma* ♀♀, and a paralyzed *Leptothorax* ♀. When dissected the 3 *Epimyrma* ♀♀ proved to be young, inseminated, but not yet egg-laying.
c) 7 other colonies contained 1 dealate *Epimyrma* ♀ each. We did not check whether these ♀♀ were young or old ones.
d) 4 colonies with 1 dealate *Epimyrma* ♀ each were apparently old colonies. When dissected, the ♀♀ proved to be inseminated, and the presence of corpora lutea in their long ovarioles indicated a previous egg-laying during the past summer season.
e) 1 colony contained 2 old, fully fertile *Epimyrma* ♀♀, however, we are not sure whether this represented a truly polygynous colony or whether by chance 2 closely neighboring colonies had been aspirated together into 1 vial (see discussion).
f) 1 colony contained one old, fertile *Epimyrma* ♀, and a dealate but not inseminated young ♀.
g) In 1 colony with 8 dealate *Epimyrma* ♀♀, 5 were newly inseminated, and 2 were fertile,

but had only quite short ovarioles as compared to the ♀♀ mentioned under d, e, and f (see section 3.5, b).

Thus, at least 4 of the 18 colonies from Corsica were just in the process of foundation, and surely one or the other of the 7 colonies mentioned under c) also was recently founded, but no longer contained the host species ♀. Hence, we conclude that ⅓ of the *Epimyrma* colonies in spring are newly founded, and the average life expectancy of a colony should be close to 3 years, with sexual production beginning in the year of foundation, and fading out in the 3. year when the host species ☿☿ die out. The highly variable number of host species ☿☿, which seems not well correlated with the number of *Epimyrma* ♀♀ produced (Tab 2), also fits to this interpretation.

3.7: Stinging of host colony ☿☿ by the *Epimyrma* ♀ was observed in spring, mainly in field collected colonies from Corsica. Between 1 and 7 dead or paralyzed *L. exilis* ☿☿ were found in 11 of the 18 colonies collected. However, stinging of host species workers does not only occur in newly founded colonies. In at least 4 colonies with old *Epimyrma* ♀♀ (proved by dissection) there were between 2 and 7 such ☿☿.

4 Description of the ♂ of Epimyrma corsica

A ♂ from Corsica was chosen as the allotype specimen. It has been deposited in the Museo Civico di Storia Naturale "Giacomo Dorina" in Genova, Italy, together with a few other ♂♂ both from Corsica and Yugoslavia.

Allotype ♂: Total length 2.78 mm, caput length 0.53 (excluding mandibulae), caput width 0.45 (behind eyes), scapus length 0.2, greatest ϕ of eyes 0.2, thorax length 0.86, width 0.46, length of petiolus 0.2, width 0.16, height 0.3, length of postpetiolus 0.13, width 0.26, height 0.26, length of praeala 2.48, postala 1.67, length of p-III femur 0.64, p-III tibia 0.47, length of gaster ca 1.06 mm.
For the dimensions of other ♂♂ from Corsica and Yugoslavia see Tab 4.
Habitus in general similar to that of other *Epimyrma* ♂♂. Mandibulae dentate with one large apical and usually 2 smaller teeth. Palpi maxillares 4-segmented, palpi labiales 2-segmented. Sometimes the segments 2 and 3 of the palpi maxillares are fused.
The normal number of antennal segments is 12 in *Epimyrma* ♂♂. However, both in *E. corsica* ♂♂ from Corsica and Yugoslavia fusions of the antennal segments 5 and 6 (with

Tab 4: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – Comparison of ♂♂ from Corsica and Yugoslavia. All dimensions in mm.

Locality	Caput		Thorax		Scapus	Petiolus			Postpetiolus		
	l*	w*	l*	w*	l*	l*	w*	h*	l*	w*	h*
Corsica, Allotype ♂	0.53	0.45	0.86	0.46	0.20	0.20	0.16	0.30	0.13	0.26	0.26
Corsica ♂$_2$	0.50	0.44	0.83	0.47	0.20	0.20	0.17	0.29	0.13	0.27	0.26
Corsica ♂$_3$	0.51	0.43	0.85	0.45	0.20	0.21	0.16	0.28	0.13	0.26	0.25
Corsica ♂$_4$	0.53	0.45	0.83	0.49	0.20	0.20	0.17	0.29	0.13	0.27	0.25
Yugoslavia ♂$_1$	0.53	0.48	0.89	0.49	0.20	0.20	0.16	0.29	0.15	0.25	0.24
Yugoslavia ♂$_2$	0.53	0.49	0.85	0.51	0.20	0.19	0.16	0.31	0.13	0.24	0.24
Yugoslavia ♂$_3$	0.52	0.47	0.83	0.49	0.20	0.20	0.16	0.27	0.15	0.24	0.24

l* = length; w* = width; h* = height.

Tab 5: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – Variation of the antennal segmentation in ♂♂ from different localities.

Locality	♂♂ with n antennal segments, left and right antenna					
	10/10	10/11	11/11	11/12	12/12	total ♂♂
Corsica	1	1	9	–	–	11
Krk	2	–	9	–	–	11
Zadar	–	1	3	2	1	7

Tab 6: *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae] – Reduction of antennal segmentation in ♂♂ of different *Epimyrma* species from various localities. The ♂♂ may have reductions in one or both antennae.

Species	locality	n ♂♂ checked	n ♂♂ with ant. seg. reduction	% ♂♂ reduction
E. ravouxi	Bavaria (D)	22	5	22.7
	Valais (CH)	20	3	15.0
	Nyons (F)	7	2	28.5
	Corsica (F)	10	5	50.0
	total	59	15	25.4
E. foreli	Calabria (I)	16	1	6.2
E. vandeli	Lauzerte (F)	11	2	18.2
E. kraussei	Ital. Alps	42	2	4.8
	Calpe (Spain)	10	2	20.0
	total	52	4	7.7
E. corsica	Corsica (F)	11	11	100
	Yugoslavia	18	17	94.4
	total	29	28	96.5

the scapus as segment 1), and of the last 2 segments are very frequent (Fig 2 and Tab 5). The segment numbers thus vary between 10 and 12, the latter being very rare.
We must stress, however, that such reductions in antennal segment numbers in other *Epimyrma* species do occur as well, hence less frequently than in *E. corsica* (Tab 6).
Clypeus with a median and 2 shorter lateral carinae. Eyes large, 3 large ocelli present. Thorax with Mayrian furrows, epinotum without spines or other projections in their place. Pronotum remarkably angular when seen from above. Petiolus not pedunculate, in lateral view with a slightly convex anterior, and a concave posterior face of the rounded node. A conspicuous ventral projection of variable shape is present (Fig 3). Postpetiolus rounded, without remarkable projections. Male genitalia: Fig 4.
Caput punctulate except from a median field between the clypeus and the anterior ocellus, which is smooth and shining. Meso- and metanotum, most parts of the sides of the thorax, and the petioli smooth and shining, the epinotum slightly rugous.

The most distinctive characters of the *E. corsica* ♂♂ are the frequent reductions in the antennal segmentation, and the ventral projection of the petiolus. We did not find the latter character in all the *Epimyrma* species the ♂♂ of which we could check (*E. ravouxi*

= *E. goesswaldi, E. kraussei, E. vandeli, E. foreli, E. stumperi, E. bernardi*), and it is also lacking in the description of *E. algeriana* [Cagniant 1968].

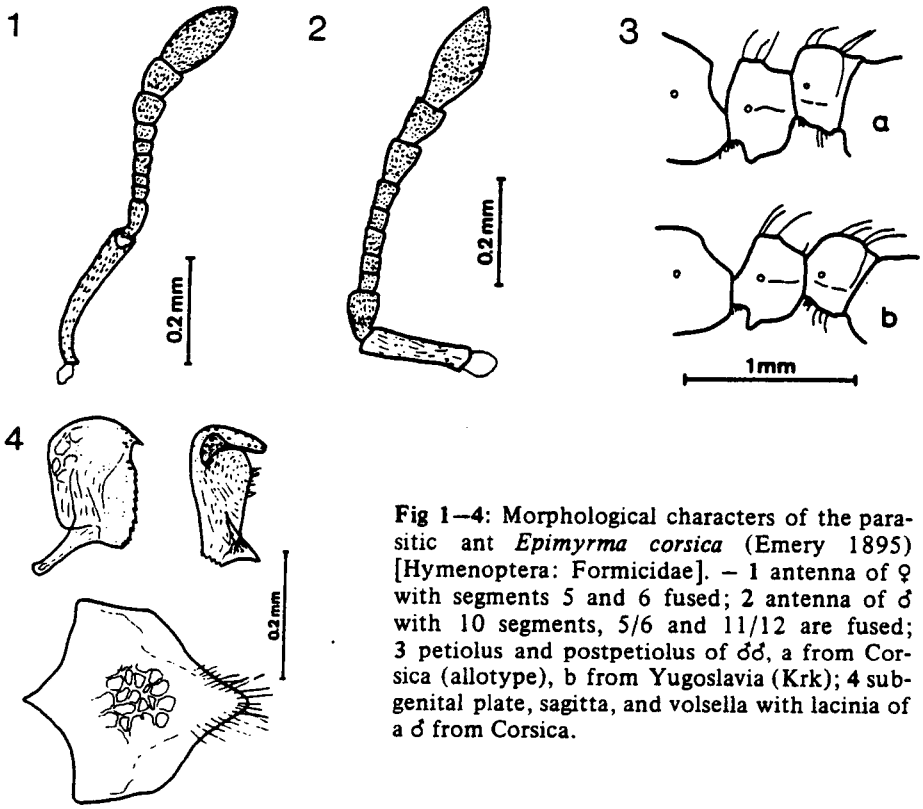

Fig 1–4: Morphological characters of the parasitic ant *Epimyrma corsica* (Emery 1895) [Hymenoptera: Formicidae]. – 1 antenna of ♀ with segments 5 and 6 fused; 2 antenna of ♂ with 10 segments, 5/6 and 11/12 are fused; 3 petiolus and postpetiolus of ♂♂, a from Corsica (allotype), b from Yugoslavia (Krk); 4 subgenital plate, sagitta, and volsella with lacinia of a ♂ from Corsica.

5 Discussion

The direct comparison of the new material from Corsica with the holotype specimen has clearly shown that we really have rediscovered *Epimyrma corsica*. We are also convinced that the material from Yugoslavia belongs to this species, despite some differences which mainly refer to the size of the ♀♀. Specimens from both areas share the particularly flat thorax (♀), the ventral projections in the petiolus (♂), and the frequent reductions of antennal segmentation (both sexes). The *Epimyrma* ☿ caste is lacking completely in both areas, and the common host species is *Leptothorax exilis*.

Epimyrma corsica, thus, is distributed in 2 geographically widely separated areas, in the type area in Corsica, and in several places along the Dalmatian coast. We do not know whether or not there exist any linking populations between these areas, however, we are sure that gene flow between the populations must have been interrupted for a very long time. Also taking into account the slight differences in shape and size of specimens of the two populations we would have good reasons to regard them as different subspecies.

With respect to the particular reproductive system of *E. corsica*, however, with a permanent inbreeding, we may expect that further populations will be detected in the future,

and that all these populations with a nearly or totally "clonal" structure, may exhibit more or less accentuated morphological peculiarities, depending upon the length of time they have developed separately. Therefore, we don't deem it advisable to give separate names to the local populations.

The inbreeding system itself, despite being uncommon in ants, has a parallel in the same genus. *Epimyrma kraussei* Emery 1915 also exhibits this strange feature [Winter & Buschinger 1983], and so do *E. foreli* Menozzi 1921 as well as *E. vandeli* Santschi 1927, which apparently represent but slightly different local populations of *E. kraussei* (unpublished observations of material from the type localities). In laboratory culture, also the ♂♀ of *E. algeriana* mate inside the nest, and the ♀♀ shed off their wings there [Cagniant 1968].

We are conscious of the problems which arise from such a reproductive system. If there really does not exist any opportunity for sexuals to leave the nest, mate with partners from other nests, and spread by flying, it is hard to understand how *E. corsica* was able to reach the islands in the Mediterranean Sea. But, even if mating outside the nest might occasionally occur, the degree of inbreeding within a given population must be excessively high. How these ants nevertheless manage to produce normal ♀♀ and ♂♂, remains an open question.

The very low number of ♂♂ produced in *E. corsica* corresponds well with the observations in *E. kraussei* [Winter & Buschinger 1983], and, like in this species, it may be a consequence of inbreeding [Hamilton 1967].

With our extensive material we are sure that *E. corsica* has lost the ☿ caste completely. Workerlessness has previously been claimed also for *E. vandeli* [Santschi 1927], however, a few colonies from its type locality, which we originally had collected without *Epimyrma* ☿☿, did produce ☿☿ in laboratory culture (unpublished). *E. corsica* thus represents the first truly workerless species in this genus. As we have stressed already in former papers [Buschinger & Winter 1982, Winter & Buschinger 1983], the genus *Epimyrma* provides good evidence for an evolution from dulotic life habits (*E. ravouxi, E. stumperi*) via the "degenerate slavemaking" of *E. kraussei* with reduced ☿ number, to the derived condition of a workerless, permanently parasitic species like *E. corsica*. Apart from morphological characters which clearly indicate that *E. corsica* is a member of this genus, also the particular colony foundation behaviour of the young ♀♀ supports this assumption.

Stinging of host species ☿☿ by the *Epimyrma* ♀ does occur in spring, both in newly infested and in older colonies. The meaning of this behavior has not yet been elucidated. However, the ♀♀ of *E. kraussei* are also known to sting some ☿☿ of their host species *Leptothorax (Temnothorax) recedens* (Nylander 1856). Workers of this species after the hibernation become fertile and generate the colonie's ♂ production [Dejean & Passera 1974]. Therefore, we have suggested that the stinging of such fertile ☿☿ may inhibit or prevent their egg-laying so that the remaining ☿☿ concentrate their brood care to the *Epimyrma* offspring [Winter & Buschinger 1983]. This explanation might also fit the stinging of *L. exilis* ☿☿ by the *E. corsica* ♀, however, it is not yet known whether they become fertile in spring like the *L. recedens* ☿☿.

Finally, some of our observations raise the question of whether or not *E. corsica* might be facultatively polygynous. All other *Epimyrma* species, as far as is known, are strictly monogynous, and also in the *E. corsica* populations from Yugoslavia we did not find any signs of a polygyny. In Corsica, however, 1 colony was found with 2 fully fertile ♀♀ (section 3.6 e, perhaps an artifact), and 1 colony (section 3.6 g) contained, alongside of a number of young ♀♀, also 2 fertile specimens, yet with short ovarioles. Twice we found

L. exilis colonies which had been simultaneously invaded by 2 resp. 3 young *Epimyrma* ♀♀ (section 3.6 b). They were just engaged with the elimination of the exilis ♀♀. This latter observation would provide an explanation for the formation of polygynous *E. corsica* colonies. We may suspect that in both cases the *corsica* ♀♀ were full sisters coming from mother colonies in the close vicinity of the newly infested host species nests. We do not know, however, whether these ♀♀ would have remained together, or whether later on, when they had become fertile, a regulation to monogyny would have occurred. Altogether, we believe that the material in question does not convincingly support the assumption of a facultative polygyny in *E. corsica*.

6 Acknowledgements

This work has been supported by grants of the Deutsche Forschungsgemeinschaft. Werner Ehrhardt, Karl Fischer and Klaus Groh have helped to collect the material during our common excursion. Hans-Peter Guthy has checked the ♂ antennae of several *Epimyrma* species. We are particularly indebted to Dr Roberto Poggi, Curator of the entomological collection of the Museo Civico di Storia Naturale "G. Doria" in Genova, for kindly providing us with the type specimen of *E. corsica*, and for his valuable help with the interpretation of its labels.

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All recent ant species are social insects. Due to the variety of species, their worldwide distribution and their wide adaption that the different biospheres have entailed, the ant has been most successful. The secret of its success is largely its social life, which is the most fascinating feature of the family. The lively interest shown in ants is reflected in the great number of papers which have been written on them. In contrast to the great number of individual works on the ant, the total of summarizing ones is severely limited – particularly in German – and there is in fact no modern German summary which deals with the different aspects of the social life of the ant in a comprehensive and generally understandable form. The author has attempted to fill this gap with this book which is not just intended for biologists, biology students and teachers, but also for those interested in social insects, in particular the social life of the ant. Due to the wealth of dissertations on the ant, it has been necessary to place limitations on the material used to present a wide selection. In so doing, the author has limited himself to presenting different aspects of the social life, whilst other aspects which were only indirectly connected with this theme, e g the role of ants in the natural economy and the hygienic and economic importance of the ant are not dealt with here. But even the presentation of the social life of the ant has meant further limitations for the author enforced by the limited size of this compilation and the general comprehension of the book. Essentially, emphasis was laid upon marking out the breadth of the subject in hand and illustrating its different aspects. Readers who are interested in specific areas within this broad spectrum will be able to inform themselves of further sources by the wealth of bibliographical data available.