

The antennal basiconic sensilla and taxonomy of *Machilinus* Silvestri, 1904 (Insecta, Apterygota, Microcoryphia)

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The antennal basiconic sensilla and taxonomy of Machilinus Silvestri, 1904 (Insecta, Apterygota, Microcoryphia).— Some special antennal sensilla ('rosettenförmige' and basiconica) of five species of *Machilinus* (Meinertellidae): *M. casasecai*, *M. helicopalpus*, *M. kleinenbergi*, *M. rupestris gallicus* and *M. spinifrontis* were studied. The distribution patterns of the sensilla are different for each examined species and identical in both sexes. The sensillogram thus provides a good taxonomic characteristic for their identification.

Key words: Taxonomy, Antennal sensilla, Basiconic sensilla, *Machilinus*.

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Introduction

The insects' antennae are provided with specialized sensilla which function, mainly, as chaemoreceptors. Their number and distribution along the antennal flagellum have been suggested as characteristics with taxonomic (LARINK, 1986) and phylogenetic (WALTHER, 1983) importance.

The sensillograms of some Machiloidea (Machilidae and Meinertellidae) were carried out by BOCKHORST (1988) who studied the distribution of all sensilla present in the antenna (chaetica, trichodea, basiconica, coeloconica and 'rosettenförmige') with optical and electron microscopy. Using Scanning Electron Microscopy (SEM), BACH et al. (1986) and FANCIULLI et al. (1988) provided more data about the types of Microcoryphia antennal sensilla.

The scales cover a great part of the Microcoryphia body. In most Machilidae, these scales are present all around the antenna, but this is not so in the case of Meinertellidae. The study of sensilla is therefore easier.

As females of *Machilinus* lack the secondary sexual characters present in males, these cannot be identified at a specific level in many cases.

The aim of the present study was to evaluate whether the distribution pattern of the basiconic antennal sensilla in *Machilinus* can be used as a specific character and whether it remains immutable in males and females of a given species.

Material and methods

The study was carried out with five *Machilinus* species. To give taxonomic significance and avoid differences related to geographical distance, the studied material was collected near description locality of each species.

Studied material

M. kleinenbergi (Giardina, 1900), 3 ♂♂ y 1 ♀, Siena (Italy) 25 VIII 89 and 23 IX 95; *M. helicopalpus* Janetschek, 1954, 8 ♂♂ y 5 ♀♀, Ávila (Spain) 10, 11 VI 95; *M. rupestris gallicus* Bitsch, 1968, 3 ♂♂ y 3 ♀♀ (paratypes) France: Draguignan 29 VI 64 and Roquebrun 6 VII 58;

M. casasecai Bach, 1974, 8 ♂♂ y 2 ♀♀, Lérida (Spain) 28 V 86; *M. spinifrontis* Bach, 1984, 4 ♂♂ y 5 ♀♀, Jaén (Spain) 11 VII 82 and 10 X 82.

The specimens were preserved with 70% alcohol. Their antennae were dissected and mounted with Tendeiro medium, the slides were dried and clarified in a heater at 35°C for 30 days.

The slides were observed with conventional optic microscopy or, when necessary, with differential interference contrast (Nomarsky).

Like all insects, Microcoryphia antenna are composed of scape, pedicel and flagellum, the latter with a variable number of annuli which, on the distal part, are arranged in clear groups called 'distal chains', also variable in number and separated by a narrow part. The distal chains of all *Machilinus* are composed of eight annuli except *M. rupestris gallicus* which has nine.

The distal chains are enumerated from the apex to the scape (n, n-1, n-2, n-3, etc.). To identify each annuli of a given distal chain, they are enumerated in the same way, the distal being number one and the basal number eight or nine (fig 1). The different kinds of sensilla are named with letters (A, B, C, etc.) preceded by the number of sensilla per annuli (1B2C1D: one sensillum B and D and two sensilla C).

Results

The sensilla studied are the basiconic and 'rosettenförmige'. All different types are represented in figure 2. The number and position of each one of them are indicated in table 1.

The 'rosettenförmige' sensillum is widely represented in many Microcoryphia species and can be found in different parts of the body. In all studied species, only one sensillum per annuli has been found and is therefore not included in table 1.

Another sensillum present in all studied species is the B (fig. 2B), which like the remaining sensilla is basiconic. Only one sensillum has been found in the first annuli of each distal chain. It is small, sunken and completely hidden, with only a small

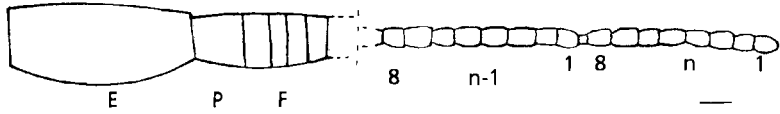


Fig. 1. Outline of *Machilinus* antenna: E. Scapus; F. Flagellum; n. Last distal chain; n-1. Penultimate distal chain; P. Pedicel; 1. Distal chain annuli 1; 8. Basal chain annuli 8. (Scale 0.05 mm.)

Esquema de antena de Machilinus: E. Escapo; F. Flagelo; n. Última cadena distal; n-1. Penúltima cadena distal; P. Pedicelo; 1. Anillo 1 (distal); 8. Anillo 8 (basal). (Escala 0,05 mm.)

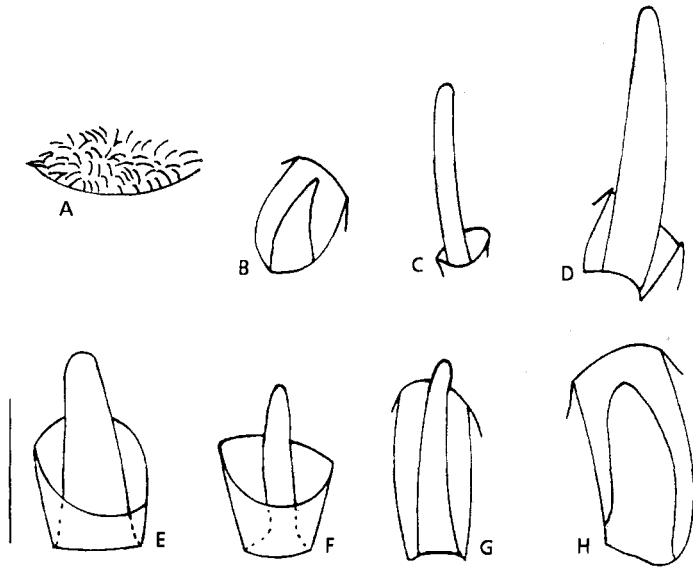


Fig. 2. Special sensilla in *Machilinus* antennae: A. "rosetenförmige" sensilla; B-H. Basiconic sensilla. (Scale 0.01 mm.)

Sensilios especiales en las antenas de Machilinus: A. Sensilio en roseta; B-H. Sensilios basicónicos. (Escala 0,01 mm.)

cuticular opening to the outside.

The C sensillum is the typical basiconic one (fig. 2C); It is found in all the species, but its number and position changes. The annuli 3 always presents the highest number (between two and four). The numbers expressed in table 1 correspond to the

most frequent case; sometimes this number changes in different distal chains of the same antenna. Moreover, as demonstrated by BACH et al. (1986) and FANCIULLI et al. (1988) using SEM, different types may be found beneath its shape.

The D sensillum (fig. 2D) is very close in

Table 1. Patterns of distribution of the sensilla in the studied species represented by means of the last two distal chains (n and n-1). All annuli present a special sensilla (A), not indicated because of its constancy. Annuli 6 to 8-9 have been omitted since they lack special basiconic sensilla: Mc. *M. casasecai*; Mh. *M. helicopalpus*; Mk. *M. kleinenbergi*; Mr. *M. rupestris gallicus*; Ms. *M. spinifrontis*.

Patrones de distribución de los sensilios de las especies estudiadas, representadas mediante las dos últimas cadenas distales (n y n-1). Todos los anillos presentan sensilio A que no se ha incluido debido a su constancia. Se han omitido los anillos del 6 al 8-9 porque carecen de sensilios basiconicos especiales: Mc. M. casasecai; Mh. M. helicopalpus; Mk. M. kleinenbergi; Mr. M. rupestris gallicus; Ms. M. spinifrontis.

Annuli	Mc		Mh		Mk		Mr		Ms	
	n	n-1	n	n-1	n	n-1	n	n-1	n	n-1
1	1B1D2C	1B1C	1B1E2C	1B1C	1B1D2C	1B1C	1B1H2C	1B1C	1B1E2C	1B1C
2			1C	1C						
3	1G2C	1G2C	1F3C	1F3C	3C	4C	4C	4C	1F2C	1F2C
4										
5		1D1C	1E1C	1E1C	1D	1D1C	1H	1H	1E	1E1C

shape to C but is stronger. It has been found only in two species *M. kleinenbergi* and *M. casasecai*. It is placed in a small cuticle depression.

The sensillum E (fig. 2E) is present in *M. helicopalpus* and *M. spinifrontis*. It is similar in shape to D but shorter and quite broad, inserted into a relatively wide and deep cuticular depression. The sensillum tip is always clearly seen outside. These two species present another sensillum (F) very close to E, but narrower (fig. 2F).

M. casasecai has a unique sensillum (G) not found in the remaining species (fig. 2G). The sensillum shape is like C but is inserted in a deep narrow cuticular depression; its tip is practically at surface level.

Finally *M. rupestris gallicus* has another typical sensillum (H) not found in the other species (fig. 2H). The sensillum shape is similar to E of *M. helicopalpus*, but closest to G of *M. casasecai* by its position in a deep cuticular depression; its tip never protrudes outside.

All these sensilla are located in a concrete position. As a result, the overall set provides the distribution pattern or sensi-

llogram for each species.

Sometimes the sensilla can appear thinner than usual. This can be due to alterations after the manipulation of the antenna. However, they can be precisely distinguished by their constant position and the characteristic cuticular base of each type.

Curiously, the pattern implies not one, but two distal chains; so is a replication ($n+n-1 = n-2+n-3 = n-4+n-5 = \text{etc.}$). Every two distal chains represent the sensillogram for each species.

The distribution patterns from table 1 include only the last two distal chains.

Discussion

In general the sensillograms expressed in table 1 are coincident with the results given by BOCKHORST (1988) though the author presents a lineal arrangement of all sensilla found, from the first to the last flagellum annuli. The differences with our results are related to the sensillum C which is considered by the author as containing various

subtypes. BACH et. al. (1986) and FANCIULLI et al. (1988) found various types of sensilla C using SEM. Their cuticular surfaces may be rough or smooth. This type of sensillum, although differing in number and position among the species, does not appear to be essential for the pattern, at least in the studied species, sensilla D, E, F, G and H being much more important. Only *M. helicopalpus* presents as characteristic a C sensillum on annuli 2. Once the sensillogram of all *Machilinus* species is known, it might be of interest to determine the differences between subtypes of sensillum C.

BOCKHORST (1988) found differences between sensilla of *M. spinifrontis* in males and females. This was not so with our specimens, as we found the distribution pattern for each species to be perfectly coincident in both sexes. Those differences are due without doubt to individual alterations of some specimen and to the low quantity of material studied.

In conclusion, not only the kind of sensilla are characteristic for some species, but also their distribution pattern, which shows constancy for males, females and subadult specimens. It would therefore seem that this taxonomic character should be included with the description of any new species.

Resumen

Los sensilios básicos de la antena y taxonomía de Machilinus Silvestri, 1904 (Insecta, Apterygota, Microcoryphia)

Se han estudiado los sensilios especiales de tipo roseta "rosettenförmige" y básicos que se hallan en las cadenas distales de las antenas de cinco especies de *Machilinus*: *M. casasecai*, *M. helicopalpus*, *M. kleinenbergi*, *M. rupestris gallicus* y *M. spinifrontis*. En todas las especies las cadenas distales constan de ocho anillos excepto las de *M. rupestris gallicus* que poseen nueve. Se han hallado siete tipos diferentes de sensilios básicos (fig. 2) de los cuales sólo uno

aparece en la misma posición y número para todas las especies (sensilio B); los restantes tipos de sensilio, o bien son exclusivos de algunas especies o bien varían en posición y número.

En la tabla 1 se da el patrón de distribución (sensiliograma) de todas las especies estudiadas. Únicamente se indican los sensilios presentes en las dos últimas cadenas distales, ya que, se ha comprobado, que es el conjunto de dos cadenas lo que constituye el sensiliograma, repitiéndose el mismo a lo largo del flagelo.

La importancia del hallazgo de esta característica radica en que el mismo sensiliograma se encuentra tanto en machos, como en hembras, como en individuos juveniles (subadultos) permitiendo la identificación específica de los ejemplares que carecen de caracteres sexuales secundarios (hembras y juveniles).

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