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Revision of the European species of the *Scaptodrosophila rufifrons* group (Diptera, Drosophilidae)

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Scaptodrosophila rufifrons (LOEW, 1873) is a senior subjective synonym of *S. lebanonensis* (WHEELER, 1949), based on the lectotype of *S. rufifrons* LOEW (Hungary is a new record for this species). *S. nitens* (BUZZATI-TRAVERSO, 1943) is the only available name for the biological species usually known as *S. rufifrons*; the neotype of *S. nitens* is designated in this paper from northern Italy. *S. abdita* sp.n. is described from Hungary. These three species are differentiated by male genital characters and by the length of the setae in the anteroventral row on the male fore femur. A solution to prevent nomenclatural problems is given. With 29 original figures.

Keywords: Drosophilidae, *Scaptodrosophila*, taxonomy, lectotype, neotype, Europe

INTRODUCTION

On the 20th of June, 1871, Ferdinand KOWARZ decided to collect flies in a cool cellar somewhere near Kasan (now Yugoslavia), instead of in the forests around, e.g., on sap runs of oaks. This decision caused a keen nomenclatural problem in the drosophilid genus *Scaptodrosophila*, as we will discuss below.

In the course of the collecting program and studies on flies captured on oozing tree sap in the Hungarian low mountains, a significant number of adults of the genus *Scaptodrosophila* DUDA, 1923 was newly collected in the last couple of years. In addition, several undescribed larvae of *Scaptodrosophila*, preserved in the collection of the Hungarian Natural History Museum were now studied.

The nominal species *Scaptodrosophila rufifrons* (LOEW, 1873) was repeatedly reported as a rarer forest species developing in oozing sap of (mainly oak) trees in Central and southern Europe. One of the other European (plus Middle East) nominal species, *S. lebanonensis* (WHEELER, 1949), is a Mediterranean-submediterranean species, which develops in fermenting fruit and is commonly found in cellars. It has been kept as a laboratory stock for more than five decades and has served as basis for dozens of scientific papers in genetics, morphogenetics, physiology, etc. making it the most frequently quoted representative of the genus *Scaptodrosophila* (the “ultimate *Scaptodrosophila* species”).

The specimens studied also included a new species from Hungary. These three species are differentiated not only by male genital characters but also by the length of the setae in an anteroventral row on the male fore femur; this is a remarkable feature, since it allows almost all of the males to be safely identified under a c. 60–100 x magnification by a simple stereomicroscope.

Specimens are preserved in the Department of Zoology, Hungarian Natural History Museum, Budapest. Preparations were made by sodium-hydroxide, genitalia kept in plastic microvials with glycerine.

SYSTEMATICS

Scaptodrosophila DUDA, 1923

Scaptodrosophila DUDA, 1923: 37 (orig. des.).

Type-species: *S. scaptomyzoidea* DUDA, 1923: 37.

Pholadoris STURTEVANT, 1942: 28.

Type-species: *Drosophila victoria* STURTEVANT, 1942.

For a complete list of synonymies see WHEELER (1981: 55).

BOCK & PARSONS (1978) published a modern revision of *Scaptodrosophila* as a subgenus of *Drosophila*. WHEELER (1981) listed 181 species in his world catalogue. Since that time numerous other species have been described; TSACAS *et al.* (1988) mentioned 224 species. BÄCHLI & ROCHA PITÉ (1984) catalogued 11 Palearctic species, of which only three species occurred in Europe: *S. deflexa* (DUDA, 1924), *S. lebanonensis* WHEELER, 1949 and *S. rufifrons* (LOEW) with *S. nitens* (BUZZATI-TRAVERSO, 1943) as a junior synonym. The species *S. pattersoni* (PIPKIN, 1956) and *S. stonei* (PIPKIN, 1956) were listed from Lebanon, but are also known from some other localities of the Middle East and Middle Asia (see BÄCHLI & ROCHA PITÉ, 1984, and MÁCA, 1988).

The differentiating characters of the genus are given by GRIMALDI (1990, p. 116) who corroborated the generic status of *Scaptodrosophila*. The species of the *victoria* species group of *Scaptodrosophila* were keyed by MÁCA (1988), and referring to the characters treated there, the differentiating characters of the *Scaptodrosophila rufifrons* species group are as follows:

- 1) width of frons at vertex only slightly greater than its median length, all orbitals nearly equidistant from eye margin;
- 2) periorbits without silvery stripes;
- 3) male hypandrium with 7–10 long setae on each side.

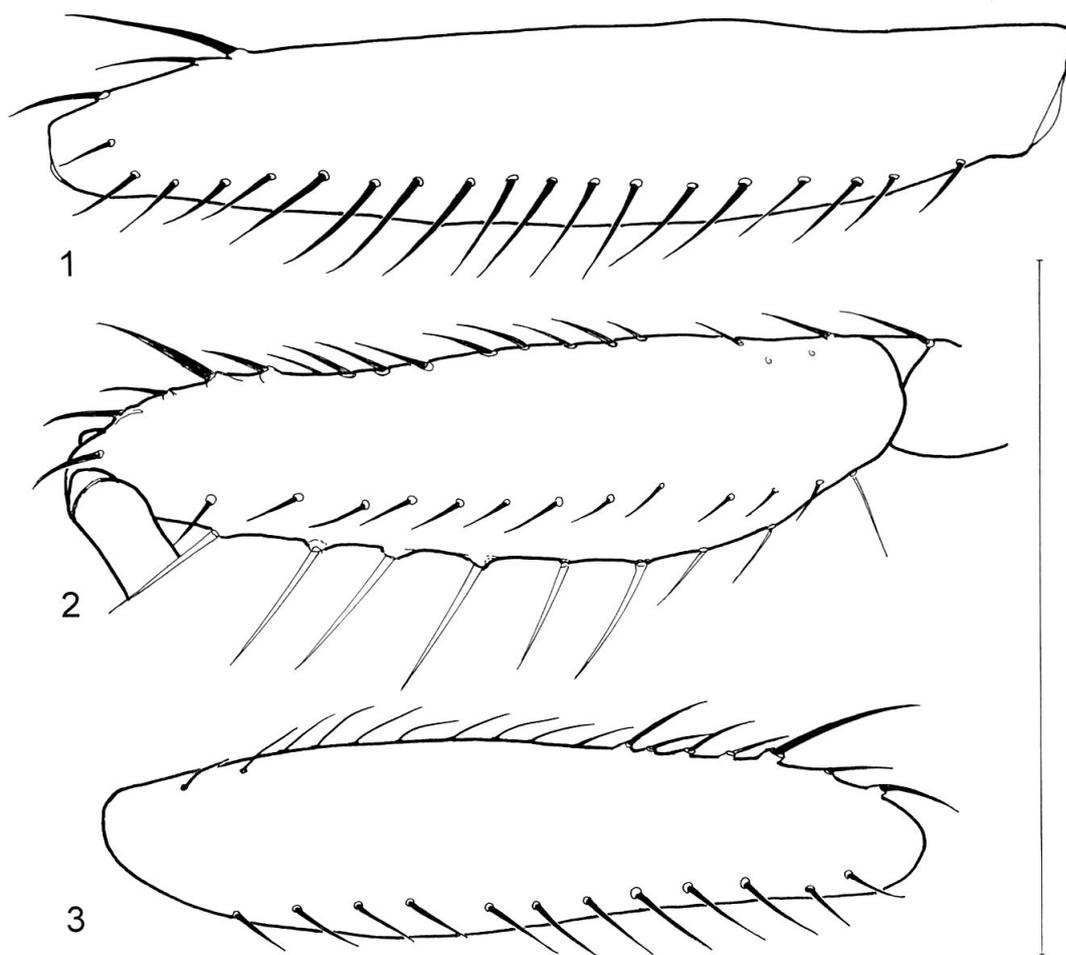
For instance, the species of the Afrotropical *S. aterrima* species group possess a single pair of very strong setae on the hypandrium, as shown by TSACAS *et al.* (1988). They also found the shape of paramere a useful character for a safe identification of species.

At present five species are included in the *rufifrons* species group: the three European species discussed below, *S. pattersoni* (PIPKIN), and *S. stonei* (PIPKIN). Some of the Japanese species may also belong here, but their study is necessary prior to such a proposal.

When we studied the two species PIPKIN (1956) described from Lebanon, based on numerous laboratory stock specimens (National Drosophila Species Resource Center, Bowling Green State University, USA laboratory stock with the identity numbers: *S. pattersoni* (Tehran, Iran): 11010 0031, *S. stonei* (Tehran, Iran): 11010–0041), we found, that on the one hand, they are not closely related to our three European species, on the other, they are not even closely related to each other.

***Scaptodrosophila abdita* L. PAPP, RÁCZ ET BÄCHLI sp. n.** (Figs 2, 6, 9, 12–13)

Body black or dark blackish brown, covered with dense fine grey microtomentum; abdomen less microtomentose, consequently more shiny. Interfrontalia dull vivid red to reddish brown, orbitalia dark silvery.



Figs 1–3. Fore femur of male *Scaptodrosophila* spp., inner (medial) view: – 1, *S. lebanonensis* (WHEELER), Spain. – 2, *S. abdita* sp. n. (also with its ventral setae). – 3, *S. rufifrons* (LOEW), Hungary. Scale: 0.5 mm.

Measurements in mm: body length 2.25 (holotype), 2.15–2.42 (paratypes), wing length 2.20 (holotype), 2.15–2.40 (paratypes), wing width 0.925 (holotype), 0.875–0.95 (paratypes).

Head characteristics and thoracic chaetotaxy as in its congeners, arista with two long ventral rays behind apical fork, presutural acrostichal macrochaetae distinct, middle katepisternal at least $\frac{1}{2}$ to $\frac{2}{3}$ as long as posterior (longest) katepisternal.

Legs black, subshiny, or, mid and hind femora somewhat brownish, tibiae reddish light brown to reddish ochreous. Male fore femur (Fig. 2) with short and thin anteroventral row of bristles.

Wings light greyish, veins ochreous or light brown. Inter-crossvein section of M 0.375 mm, distal section of M 0.975 mm on the holotype.

Male genitalia: dorsal process of surstylus weak and without setae (Fig. 6). Paramere (Fig. 9) comparatively narrow, long bristles on hypandrium (Fig. 12) shorter than in the other two species.

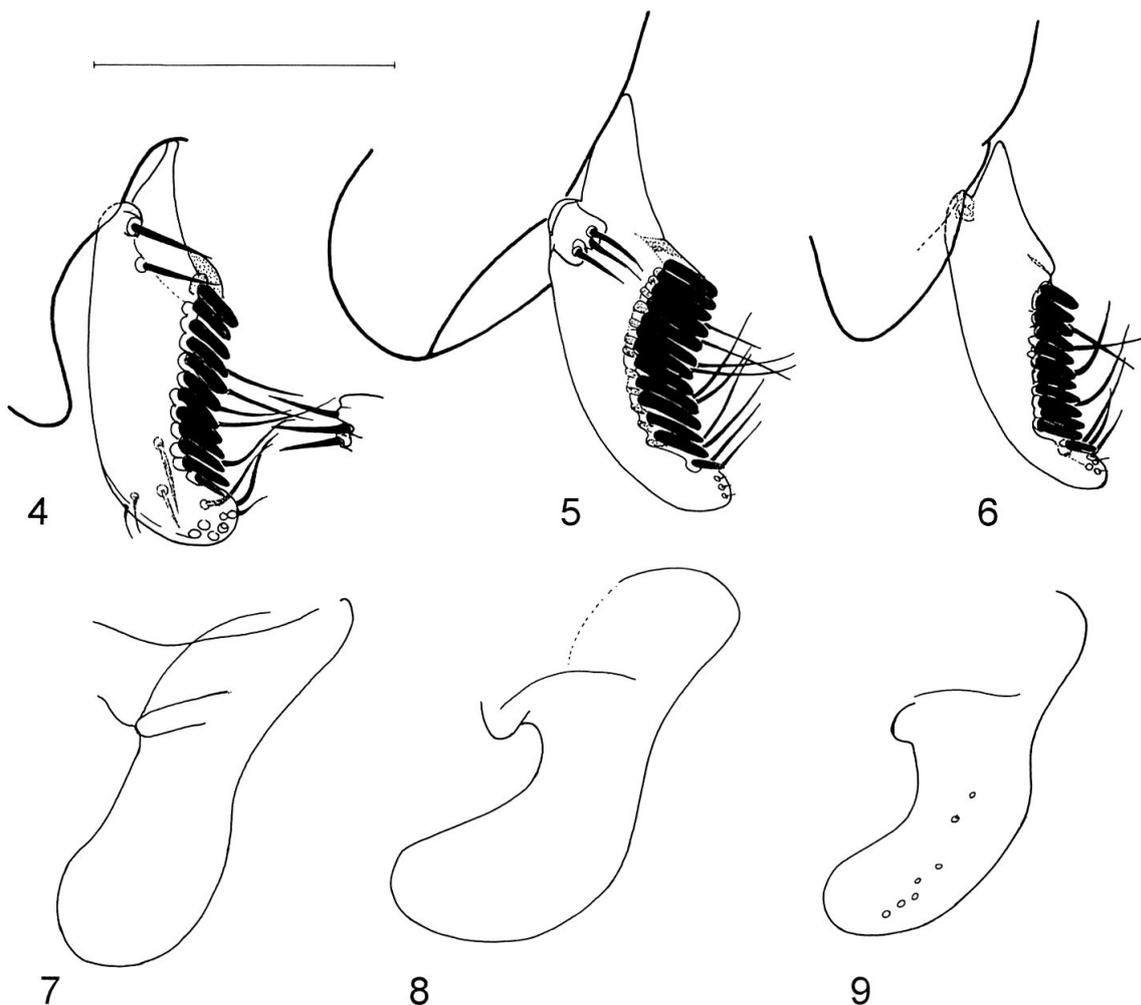
Female oviscapt with lateral peg close to apical pegs (Fig. 13).

Holotype ♂: [Hungary] Börzsöny-hg., Magyarokút [Verőce] – 1957.VII. 10–13., leg. SZÉKESY.

Paratypes: 53 ♂♂: same data; 9 ♂♂: ibid., 1988.IV.8., leg PAPP L. – gyertyán és tölgy kicsorgó nedvén; 1 ♂: ibid., tölgyek kicsorgó nedvéről, 1992.V.17., leg. PAPP L.; 5 ♂♂: Börzsöny-hg., Királyrét [Szokolya] – 1971.VI.24., leg. PAPP L. – tölgy kicsorgó nedvén; 1 ♂: Hortobágy N. P., Újszentmargita – Margitai erdő, 1976.III.30., WC, leg. PAPP L.; 2 ♂♂: K[iskunsági] N. P.: Tóserdő, Lakitelek, tölgyfa kicsorgó nedvéről, 1978.5.25., leg PAPP L.; 4 ♂♂: A[ggteleki] N. P., Szin, Ménesvölgy, part, 350 m, 1987.IX.16., leg. PAPP L.; 1 ♂: Budapest KERTÉSZ, 1921. VII.2. – “*D. rufifrons* Lw.” det. Dr. O. Duda; 1 ♂: ibid., 1907.VI.25.; 1 ♂: Szászka [Saska Romana] KRISTEN, 10.IV.904. Total of 78 ♂♂ paratypes.

The holotype was selected out from the type-series on account of its exposed genitalia: parameres and mostly also hypandrium are visible and well recognizable under c. 100 x magnification.

One ♀ (Szendehegy, Keskenybükki-patak v., levágott juhar- és gyertyáncsonkok, 1996.IV.7., leg PAPP L.) suspected to represent the female of this species depicted in Fig. 13.



Figs 4–9. Genitalia of male *Scaptodrosophila* spp.: 4–6, surstylus, broadest extension (subventral view). 4, *S. lebanonensis* (WHEELER), Spain; 5, *S. rufifrons* (LOEW), Hungary; 6, *S. abdita* sp. n. – 7–9, paramere (paraphysis), broadest extension; 7, *S. lebanonensis* (WHEELER), Spain; 8, *S. rufifrons* (LOEW), Hungary; 9, *S. abdita* sp. n. Scale: 0.1 mm.

***Scaptodrosophila rufifrons* (LOEW, 1873)** (Figs 3, 5, 8, 10, 15–17, 27–29)

Drosophila rufifrons Loew, 1873: 50 (see discussion below).

Type-locality: originally not given [from the title of his paper: "Pannonia inferiori et in confinibus Daciae"].

Drosophila nitens BUZZATTI-TRAVERSO, 1943: 38.

Material studied:

Neotype ♂ of *S. nitens* (designated here): Italy, Veneto: Treviso, Villa Margherita, 11 June 1998, oak sap, leg. Dr. S. VANIN. This neotype is selected among specimens collected at one of the type localities of *S. nitens*. Deposited in the HNHM.

Specimens collected with the neotype: 2 ♂♂: same data (one of them with gen. prep. in a plastic microvial); 1 ♂: *ibid.*, 21 May.

Other material studied: **Yugoslavia**: 1 ♂ (HNHM, much damaged): Vlastic, THALHAMMER. **Hungary**: 39 ♂♂: K[iskunsági] N. P.: Kunfehértó, *Morus alba* kicsergő nedvén [oozing sap], 1982.VI.15–23., leg. PAPP L. (oviscapt of one of the females with these data is depicted in Fig. 15); 25 ♂♂: Budapest, Pestszentlőrinc, Péterhalmi-erdő, szilfák sebéről, 1996.V.11–12, 1997.V.3., etc.; 6 ♂♂: Budapest KERTÉSZ; 1 ♂: Domogled, Pável [18]95.V.13.; 1 ♂: Berzászka Pável, VII. [18]98; 3 ♂♂: Börzsöny-hg., Magyarkút, etc. (same as for the holotype of *S. abdita*). 4 ♂♂: Bükk hg., Tard (actually not in the Bükk Mountains); 1 ♂: A[ggteleki] N. P.: Komjáti, Lótusz-forrás, 200 m, 1990.VIII.14., leg. PAPP L.; 1 ♂: A.N.P.: Szin, Ménesvölgy, part, 300 m, 1987.IX.16., leg. L. PAPP; 1 ♂: Hortobágy N. P., Újszentmargita – Margitai erdő, 1975.V.29., leg. PAPP L. Total of 83 ♂♂.

All syntype specimens of *S. nitens* were stored at the "Istituto di Zoologia e Genetica della R. Università di Pavia" (BUZZATI-TRAVERSO, 1943). Unfortunately, when Adriano BUZZATI-TRAVERSO left this Institute for Rome, nobody took care of this collection. All later attempts by different persons to localize the type specimens were unsuccessful. Therefore, all syntype specimens of *S. nitens* are considered to be lost. We should mention that this is also the case for *Drosophila tigrina* BUZZATI-TRAVERSO, 1943.

The International Code of Zoological Nomenclature has strong regulations regarding the designation of a neotype. We want to emphasize that the designation of a neotype for *S. nitens* is essential to clarify the identity of this nominal species.

Description of the neotype:

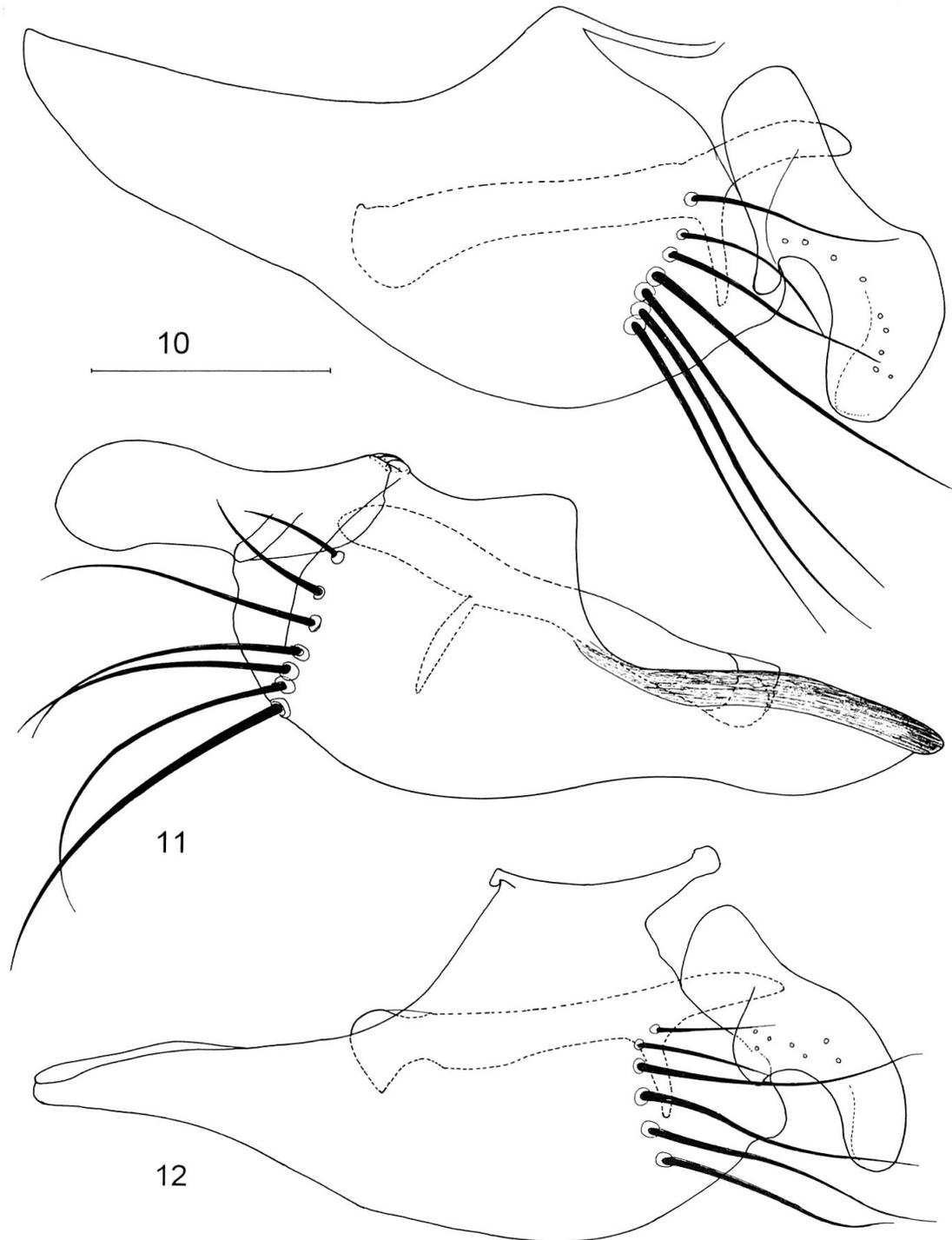
Measurements in mm: body length 2.40 (neotype), 2.25–2.45 (males caught together), wing length 2.32 (neotype), 2.20–2.42 (other males), wing width 0.98 (neotype), 0.915–1.00 (other males).

Body brown, reddish brown on humeral callus and most anterior parts of thorax, covered with grey microtomentum. Frons dull blackish brown with some reddish hue (particularly so around ocellar triangle), orbital plates black, subshiny. Legs mainly brown, mid and hind femora reddish brown, mid and hind tibiae and all tarsi greyish-reddish ochreous. Male fore femur with an anteroventral row of longer and thicker bristles than in *S. abdita*, though bristles (Fig. 3) shorter and less dense than in *S. lebanonensis*. Wings greyish, veins light brown.

Male paramere visible without preparation, so its genitalia were not prepared, details of genitalia of a male caught together with the neotype are given in Figs 27–29 (see also Figs 8, 10). Dorsal process of surstylus definite and with 2 or 3 setae (Figs 5, 27), apical part of surstylus more slender, prenisetae comparatively longer than in *S. lebanonensis*. Parameres (Figs 8, 29) more robust, apex of paramere slightly latero-clinate and apical half curved (Figs 8, 29), apical part of hypandrium less robust than in *S. lebanonensis* (Figs 10, 28, cf. Figs 11, 21, 24).

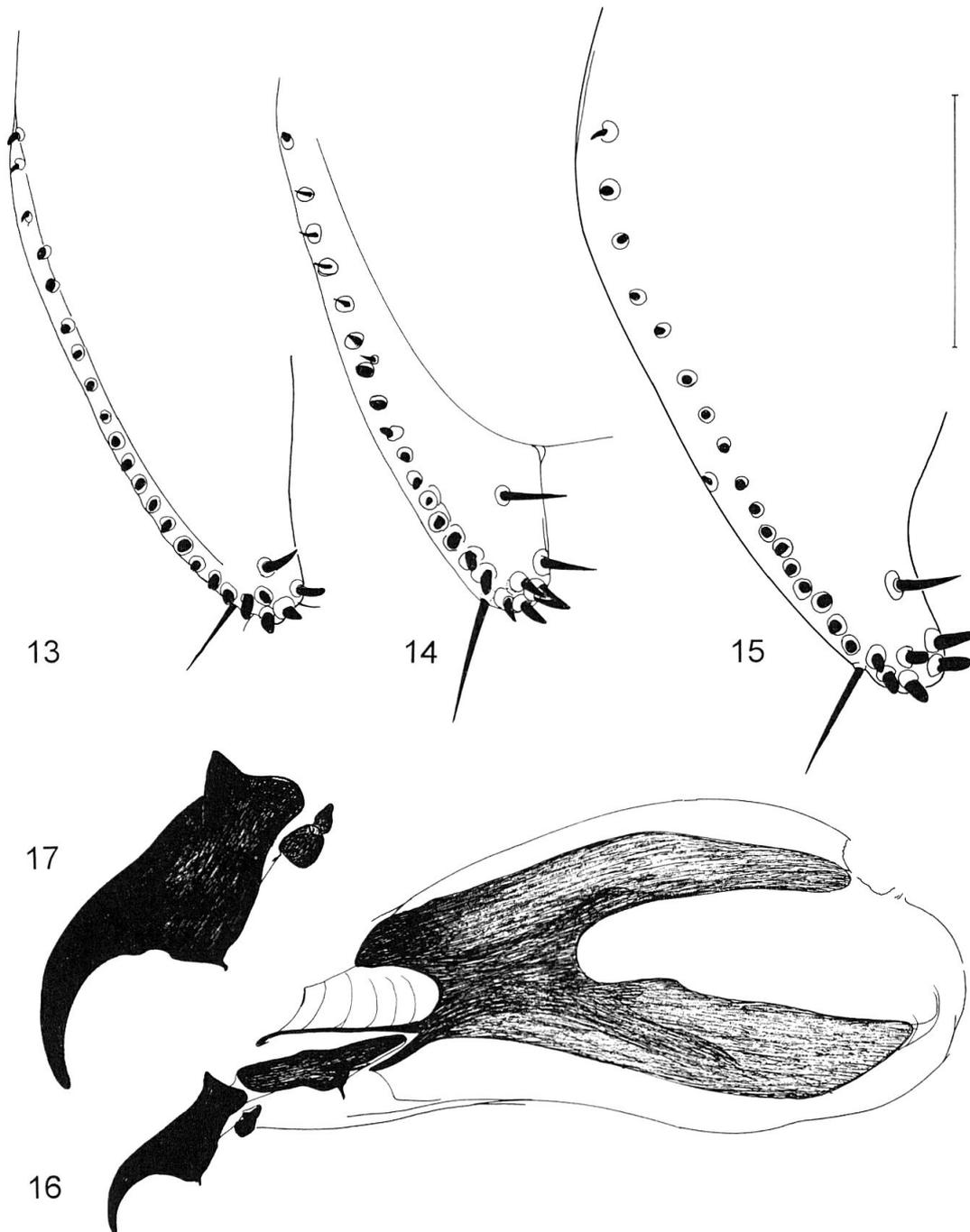
Female oviscapt with lateral peg far above apical pegs (Fig. 15).

Sympatric occurrences of the *S. abdita* and *S. rufifrons* populations are: Budapest, Börzsöny-hg.: [Verőce] Magyarút, Hortobágy N. P.: Újszentmargita, Aggteleki N. P.: Szin, Ménes-völgy. Otherwise *S. abdita* was found in the low mountains of Hungary and *S. rufifrons* on the lowlands.



Figs 10–12. Male inner genitalia, lateral view: – 10, *S. rufifrons* (LOEW), Hungary, 11, *S. lebanonensis* (WHEELER), Spain, 12, *S. abdita* sp. n. Scale: 0.1 mm.

OKADA (1968) not only recorded *S. rufifrons* from Japan but also gave a figure of the cephalopharyngeal skeleton of its third instar larva. Comparing his figures to the cephalopharyngeal skeleton of the larvae collected in the Péterhalmi forest of Pestszentlőrinc, Budapest, belonging, as we have reason to believe, to *S. rufifrons* (a higher number of *S. rufifrons* adults were also captured), we can state



Figs 13–17. – 13–15, female oviscapt, lateral view: 13, *S. abdita* sp. n.; 14, *S. lebanonensis* (WHEELER), Spain; 15, *S. rufifrons* (LOEW), Hungary. – 16–17, *S. rufifrons* (LOEW), third instar larva (Budapest), cephalopharyngeal skeleton, lateral view: 16, the entire CPH skeleton; 17, mouth hook with dental sclerite, in higher magnification. Scale for Figs 13–15: 0.1 mm.

that OKADA's species is not similar to ours at all. In all probability OKADA's biological species published as *S. rufifrons*, does not even belong to the *S. rufifrons* species group (Figs 16–17).

***Scaptodrosophila lebanonensis* (WHEELER, 1949)** (Figs 1, 4, 7, 11, 14, 18–26)

Drosophila lebanonensis WHEELER, 1949: 143.

Type-locality: Beirut (Lebanon).

Drosophila lebanonensis casteeli PIPKIN, 1961: 149.

Lectotype ♂ of *D. rufifrons*: designated by BÄCHLI (1982: 295; misprinted as “♀”, corrected in BÄCHLI, 1984: 254).

Pinned upside down on a 00 insect pin with labels:

1) “Kasan 20.5.71”; 2) coll. H. LOEW; 3) [LOEW's handwriting] ?*Drosoph.* n. sp.”; 4) “*D. rufifrons* LW.” det Dr. O. DUDA; 5) ♂; 6) “*D. rufifrons* LW. lectotypus”, G. BÄCHLI det 1982; 7) Zool. Mus. Berlin.

In a good state of preservation; abdomen removed (and kept in microvial with glycerine) with an excellent gen. prep. by J. MÁCA and G. BÄCHLI.

Other specimens in the ZMB with type labels but they are not types (cf. BÄCHLI 1982, 1984): 3 ♂♂, 1 ♀: “Silesia Jun 1958” – coll. H. LOEW; “Silesia SCHNAIDER” – coll. H. LOEW; 1 ♂, 1 ♀: “Brest, SCHOLTZ”. At least one of them is *S. abdita*.

In spite of repeated requests we did not manage to get any of the types of *D. lebanonensis* WHEELER; however, since the type-series was selected from specimens of the stock mentioned below, there is but a minor bias about the identity of *D. lebanonensis*.

Other material studied: Numerous specimens from the stock of the National Drosophila Species Resource Center, Bowling Green State University, USA (stock # 11010–0021) originating from Beirut, Lebanon; numerous specimens from the stock maintained by Dr. L. SERRA, originating from “Spain, Gandesa, from a wine cellar” (9 ♂♂ and 4 ♀♀ pinned in the collection of the HNHM); 1 ♂: Aranyosgadány, 1970. X. 19. – törköly, leg. L. PAPP (see PAPP, 1975, under “*Drosophila rufifrons*”). 2 ♂♂, 1 ♀: *ibid.*, présház gyümölcscefre [fermenting fruit mash] – 1997. VIII. 16., leg. PAPP L.

As a mean, somewhat bigger than *S. rufifrons* (particularly so for some specimens in laboratory stocks), up to 2.7 mm or even slightly longer.

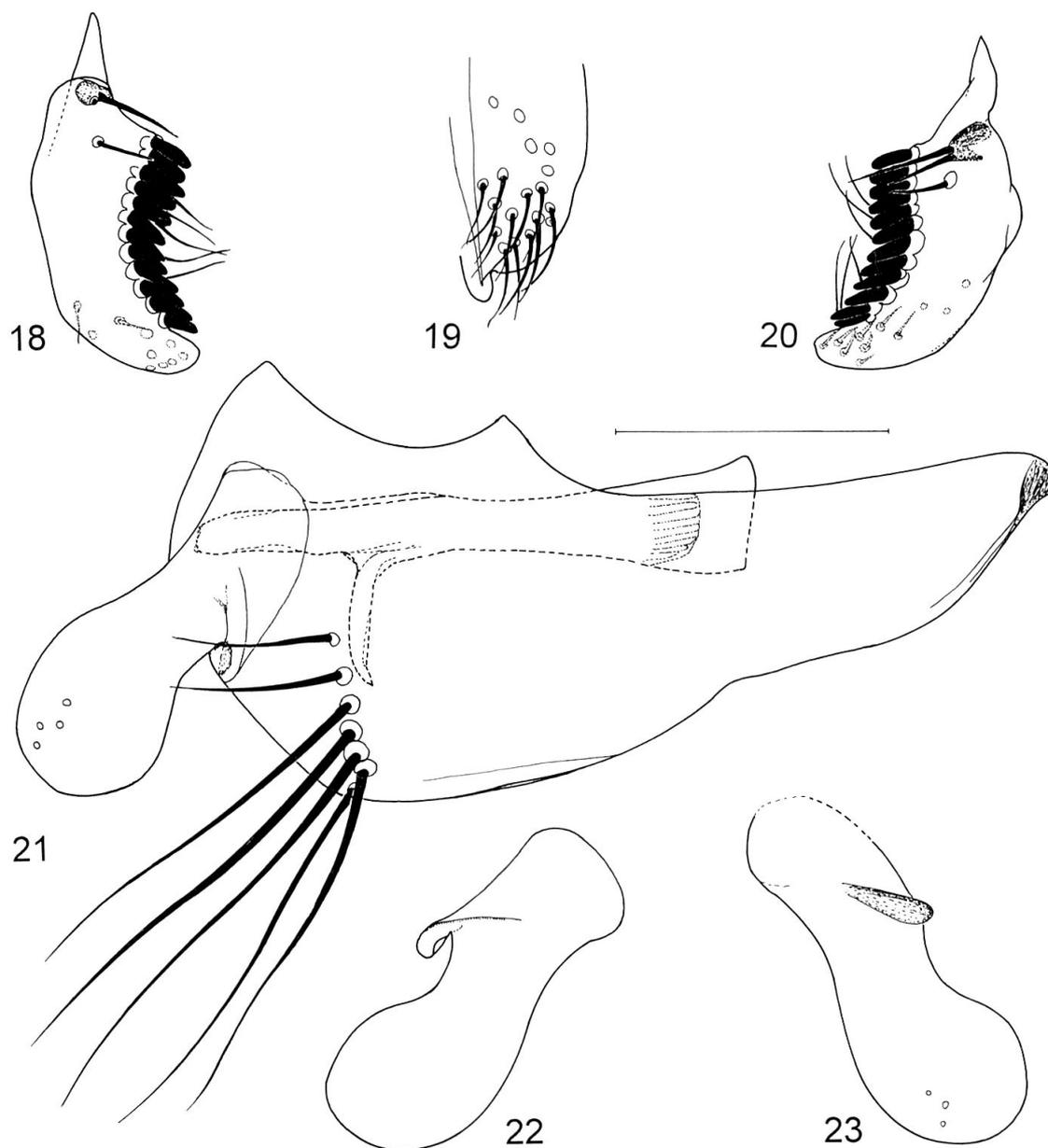
Middle katapisternal $\frac{2}{3}$ to $\frac{3}{4}$ (in some specimens $\frac{4}{5}$) length of the posterior one. Bristles in the anteroventral row of male fore femur (Fig. 1) longer, thicker and denser than in the two related species.

Ventral bristles on epandrium (and also on cerci, Fig. 19) tend to be longer than in *S. rufifrons*. Dorsal process of surstylus definite and with 2 or (rarely 3) setae (Figs 18–20, 25), apical part of surstylus robust, prenisetae comparatively shorter (Figs 18–20, 25) than in *S. rufifrons*. Parameres (Figs 7, 22–23, 26) robust, apex of paramere parallel with body axis and apical half not curved (also on Figs 11, 21, 24).

Female oviscapt with lateral peg far above apical pegs (Figs 14).

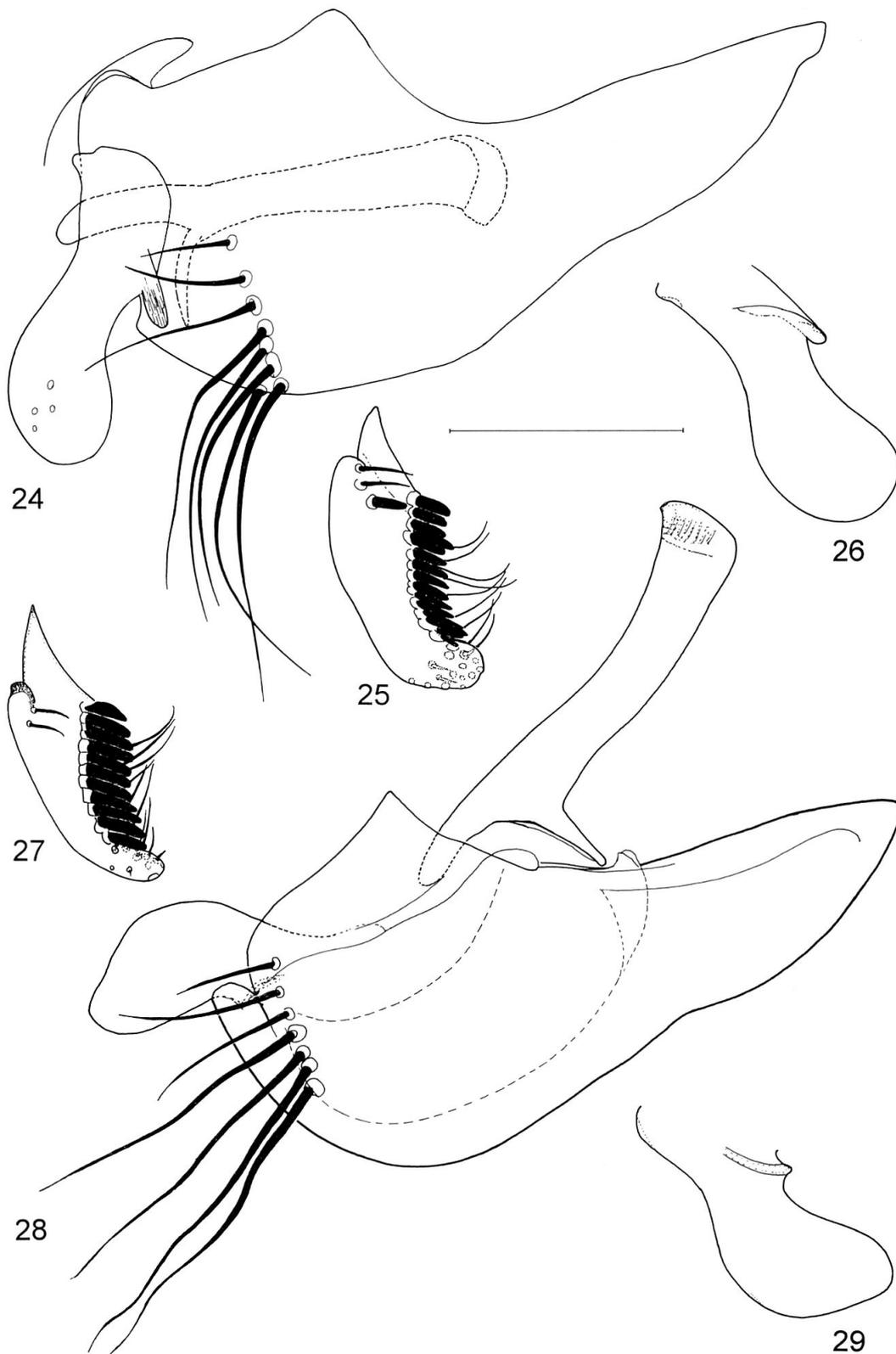
HSU's (1949) figure (Pl. IV/7) is improper to identify this species.

Distribution: Spain to Greece, Lebanon and Israel (WHEELER, 1981; BÄCHLI & ROCHA PITÉ, 1984), Canary Islands (BÄCHLI & ROCHA PITÉ, 1984). Later records: Ukraine, Yalta (IVANNIKOV *et al.*, 1993), Tadjikistan, Dushanbe (IVANNIKOV & ZAKHAROV, 1994). The above records are the first ones for Hungary.



Figs 18–23. Male genitalia of the lectotype of *Drosophila rufifrons* LOEW, 1873: – 18, left surstylus, broadest extension (subventral view). – 19, ventral part of right cercus. – 20, right surstylus, broadest extension (subventral view). – 21, inner genitalia, lateral view. – 22, left paramere, broadest extension. – 23, right paramere, broadest extension. Scale: 0.1 mm.

The only known locality in Hungary is a small press-house of a cellar in Aranyosgadány (S Hungary), where it was collected in 1970 and 1973 and again in 1997, so the small local population is thought to have survived for decades. However, later in 1997 and from June to September 1998 no specimen was collected there again, in spite of the capture and identification of several thousand drosophilid specimens. It seems rare also in Greece, Ukraine and Tadjikistan (cf. TRIANTAPHYLLIDIS & TSACAS, 1981, IVANNIKOV *et al.*, 1993, IVANNIKOV & ZAKHAROV, 1994).



Figs 24–29. – 24–26, genitalia of a male of *S. lebanonensis* (WHEELER) from Hungary: 24, inner genitalia, lateral view; 25, left surstylus, broadest extension (subventral view); 26, right paramere, broadest extension. – 27–29, genitalia of *S. rufifrons* (LOEW), a male caught with the neotype: 27, left surstylus, broadest extension (subventral view); 28, inner genitalia, lateral view; 29, right paramere, broadest extension. Scale: 0.1 mm.

Key to the European species of the S. rufifrons species group

- 1 Male fore femur (Fig. 2) with an anteroventral row of short and thin bristles. Dorsal process of surstylus weak and without setae (Fig. 6). Paramere (Fig. 9) comparatively narrow, long bristles on hypandrium shorter than in the other two species (Fig. 12). Female oviscapt with lateral peg close to apical pegs (Fig. 13) *abdita* sp. n.
- Male fore femur (Figs 1, 3) with an anteroventral row of longer and thicker bristles. Dorsal process of surstylus definite and with 2 or 3 setae (e. g. Figs 4–5). Parameres (Figs 7–8) more robust. Female oviscapt with lateral peg far above apical pegs (Figs 14–15) 2
- 2 Bristles in the anteroventral row of male fore femur (Fig. 3) shorter. Apex of male paramere slightly latero-clinate and apical half curved (Figs 8, 29). Apical part of surstylus more slender, prenisetae comparatively longer (Figs 5, 27). Larvae develop in sap flows (mainly of oaks) ... *rufifrons* (LOEW, 1873)
- Bristles in the anteroventral row of male fore femur (Fig. 1) longer. Apex of male paramere parallel with body axis and apical half not curved (Figs 7, 22–23, 26). Apical part of surstylus robust, prenisetae comparatively shorter (Figs 18–20, 25). Larvae develop in fermenting fruits, i.e., synantropic
..... *lebanonensis* (WHEELER, 1949)

As a comparison of our figures shows, a considerable variation by localities is detectable in the details of the genitalia. That is why one of us (O.R.) was to compare specimens from Hungarian populations and in laboratory stocks by RABD-PRC. Much to our regret, we were not successful in collecting adults in 1998, so this study has to be postponed.

The species IMASHEVA *et al.* (1994) reported from Daghestan as “*Drosophila* (*Scaptodrosophila*) cf *lebanonensis* WHEELER” may be *S. rufifrons*, but is more probably a new species of this species group.

Nomenclatural status of S. rufifrons and S. lebanonensis

As we have shown above, the lectotype of *Drosophila rufifrons* LOEW is actually conspecific with *Drosophila lebanonensis* WHEELER. Therefore, the species known as *S. lebanonensis* should be named *S. rufifrons*, and for the species known as *S. rufifrons*, the replacement name *S. nitens* BUZZATI-TRAVERSO has to be used. However, *S. rufifrons*, mentioned in at least 155, *S. lebanonensis* in at least 107 publications, are both ecologically distinct and have never been confused. The names to be used according to the nomenclatural rules would produce instability. There is only one proper solution. One of us (G.B.) has written an application to the International Commission of Zoological Nomenclature (case 3128) proposing to suppress the lectotype selection of *D. rufifrons*, which would have to be replaced by a neotype selection in conformity with the permanent use of the names of the two species involved.

Until the formal regulation by the Commission, the existing usage of the names is being maintained, as allowed by Article 80 of the Code (pers. comm. Dr. Philip TUBBS, London).

ACKNOWLEDGEMENTS

Our grateful thanks are due to Prof. J. S. YOON for sending laboratory stock specimens from the National Drosophila Species Resource Center, Bowling Green State University (U.S.A.), to Dr. S. VANIN and Dr. L. MUNARI for collecting and transferring material proper for selecting a neotype of *S. nitens*, to Dr. J. MÁCA for making preparations of genitalia of various specimens, to Prof. L. SERRA for providing specimens from Spain, and to Dr. L. NIGRO, Padova, for helping to get information regarding the original type series of *S. nitens* BUZZATI-TRAVERSO. Our studies were supported by the Hungarian National Science Research Fund (OTKA T16892, 1995–8) for which we also express our thanks here.

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