

*Bacillus grandii* n. sp. and *B. whitei* n. sp.: two new stick  
insects from Sicily (Cheleutoptera, Bacillidae).

INTRODUCTION

Two species of the genus *Bacillus* (Latreille, 1825) were found up to now in Italy: *B. rossius* (Rossi) and *B. atticus caprai* Nascetti and Bullini. The former is a bisexual species having both amphigonic and parthenogenetic biotypes, whereas the latter reproduces by constant thelytoky (Bullini, 1965 and 1969; Nascetti and Bullini, in press). The occurrence of a third species, *B. tripolitanus*, is doubtful, being accounted for only on the basis of a few museum specimens from Sicily (Westwood, 1859; Harz and Kaltenbach, 1976); also the systematic status of this taxon, in our opinion a North-African subspecies of *B. rossius*, is still uncertain. Aim of this paper is to describe two new *Bacillus* species, recently discovered in Sicily.

*Bacillus grandii* n. sp.

MATERIAL EXAMINED - Holotype: ♂, surroundings of Noto (Syracuse), October 5, 1981, G. Nascetti leg. Preserved in the collection of the Civic Natural History Museum « Giacomo Doria » in Genoa. Paratypes: 3 ♂♂ and 6 ♀♀ from the type locality (October 4-6, 1981, G. Nascetti leg.). Preserved in the collections of the Civic Natural History Museums in Genoa (1 ♂, 2 ♀♀), Milan (1 ♂, 2 ♀♀) and Verona (1 ♂, 2 ♀♀); other material examined: 7 ♂♂ and 5 ♀♀ collected on 1980 and 1981, from May to November, near Noto, m 150, Palazzolo Acreide, m 670, and Canicattini Bagni, m 360 (Syracuse district).

DIAGNOSTIC CHARACTERS - Differentiated from *B. rossius* and *B. atticus* for the shape of lamina subgenitalis, vomer subanalis and cerci (figg. 1a, b and 2a), for the male legs colour pattern (fig. 3b), for the capsule sculpturing and operculum morphology of the egg (fig. 4a, b, c), for the karyotype (see below).

HOLOTYPE DESCRIPTION - Adult male (fig. 3a); colour brown. Total length 62 mm 20 articles antennae, 11 mm long. Head: 2.7 mm long. Thorax

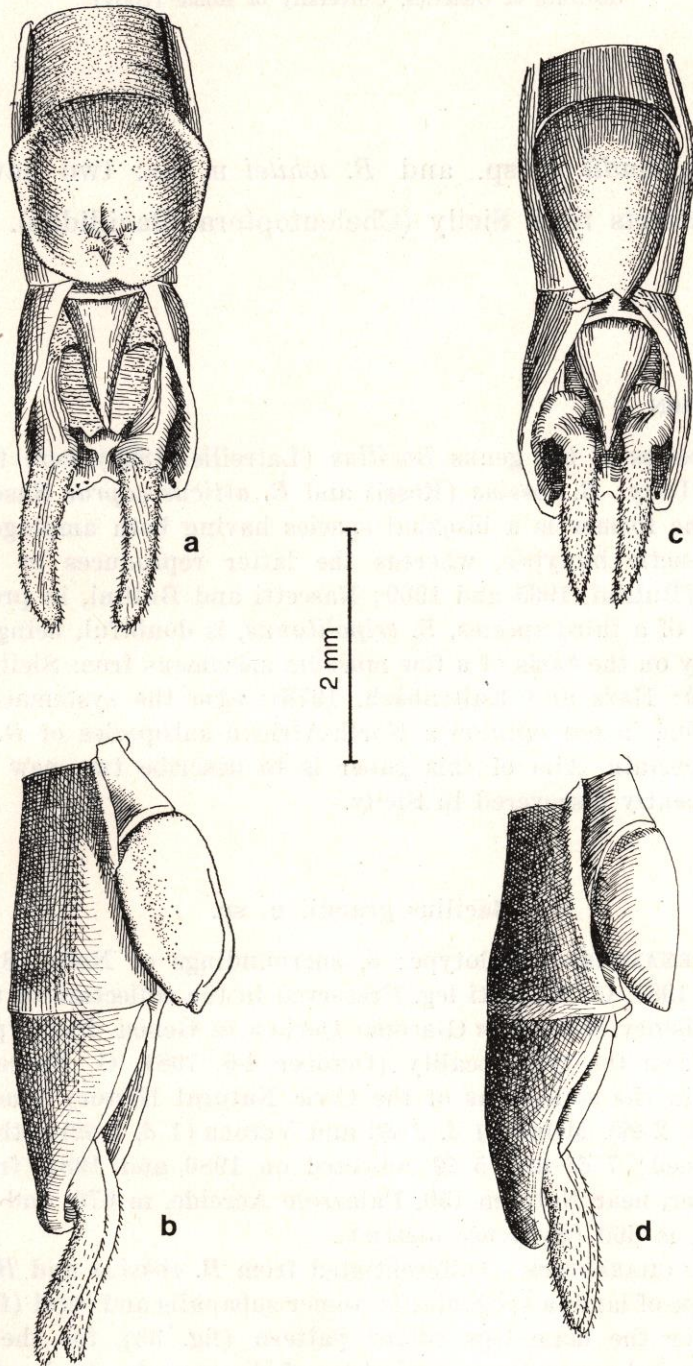


FIG. I  
End of abdomen of *Bacillus grandii* (on the left) and *B. rossius* (on the right) adult males; a, c: ventral view; b, d: lateral view.

segments: pronotum 2.3 mm, mesonotum 12.8 mm, metanotum + median segment 12.9 mm. Meso- and metathorax without evident granulation. Lamina subgenitalis large and roundish, reaching the end of the 9<sup>o</sup>

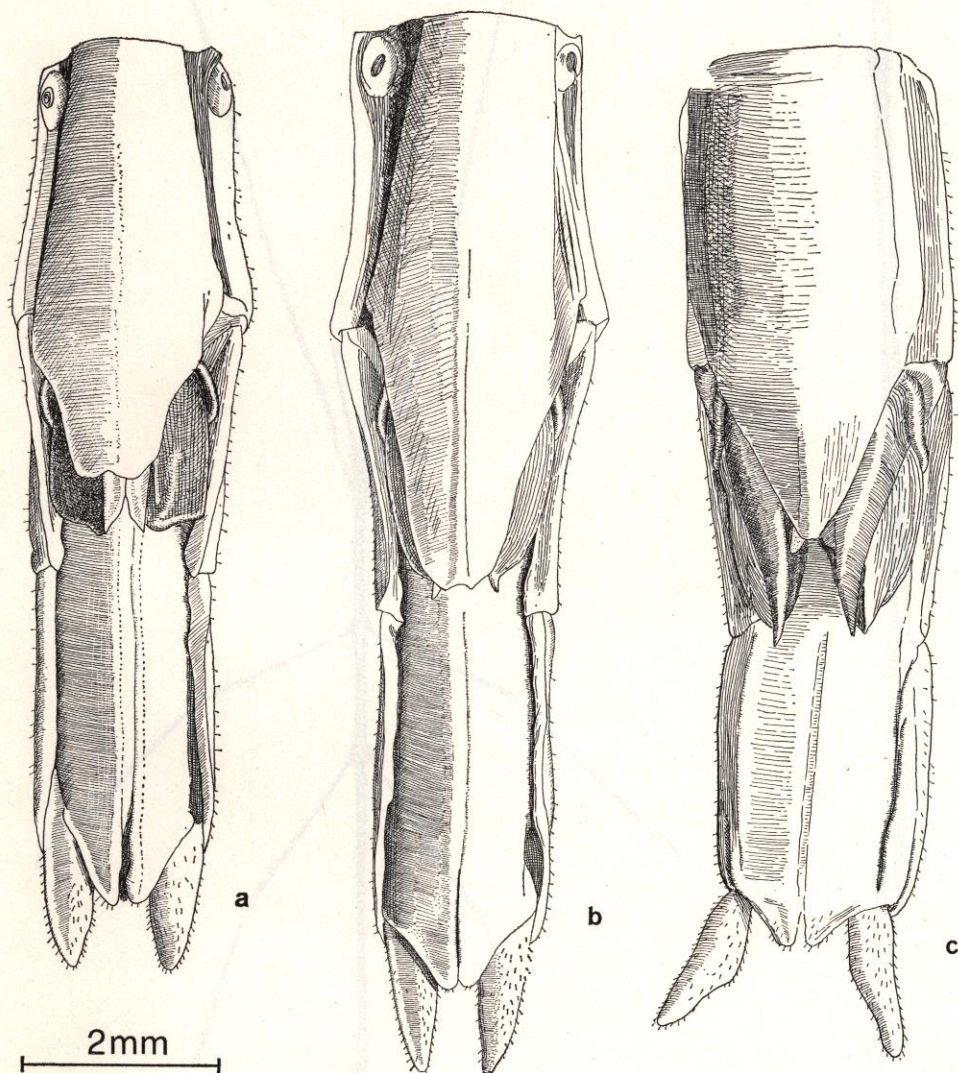


FIG. II

End of abdomen of *Bacillus grandii* (a), *B. whitei* (b) and *B. rossius* (c) adult females; ventral view.

segment. Cerci 1.5 mm long. Fore femora not denticulated, 23.3 mm (right) - 21.2 mm (left) long; median and hind femora slightly denticulated, respectively 16.5 mm and 19.7 mm long. Tibiae length: fore 30.1

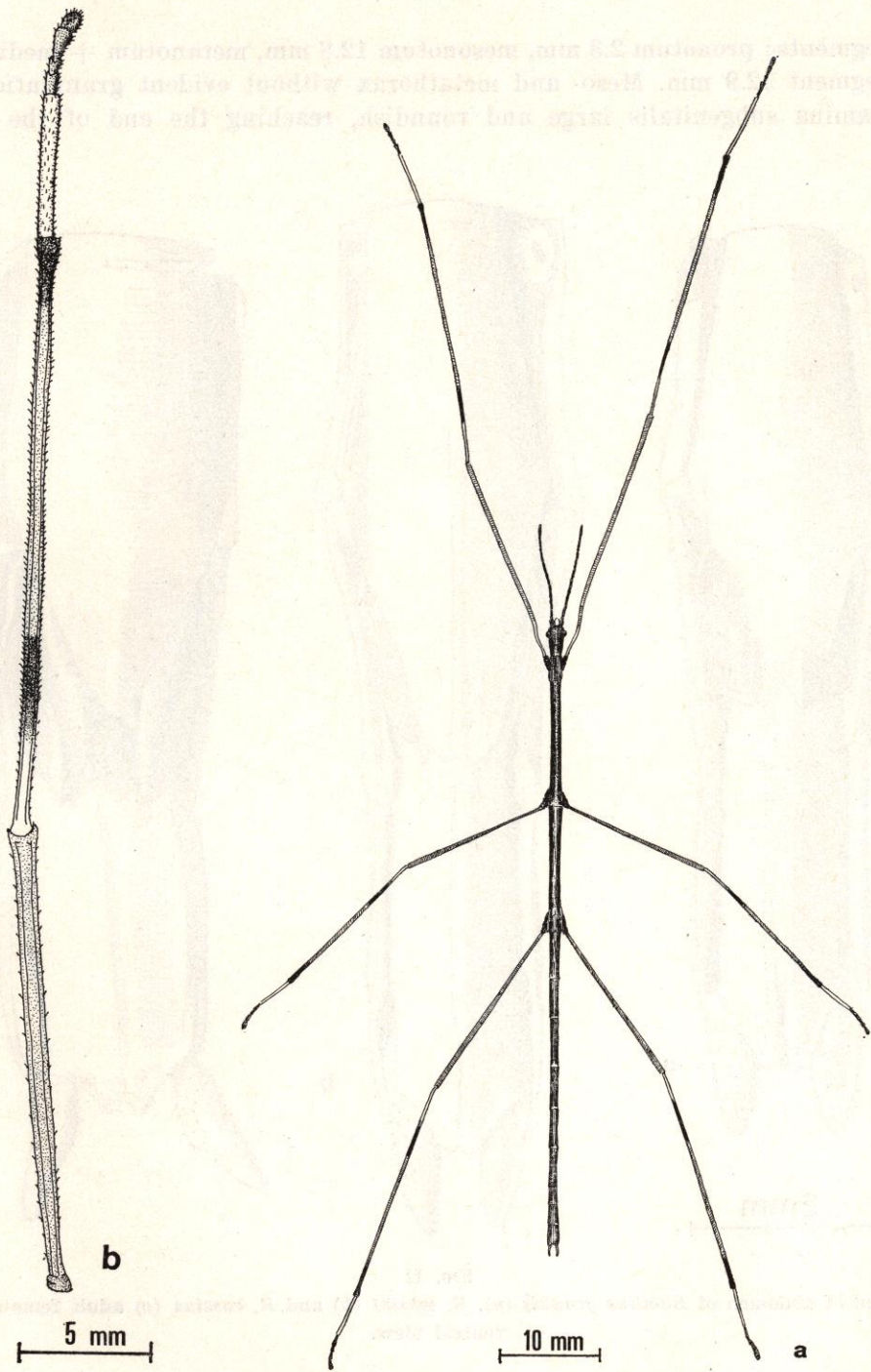


FIG. III  
*Bacillus grandii* from Noto (Sicily); a: adult male, dorsal view; b: fore leg, showing  
the disruptive colour pattern.

mm (right) - 26.5 mm (left), median 17.6 mm, hind 22.1 mm. Legs with

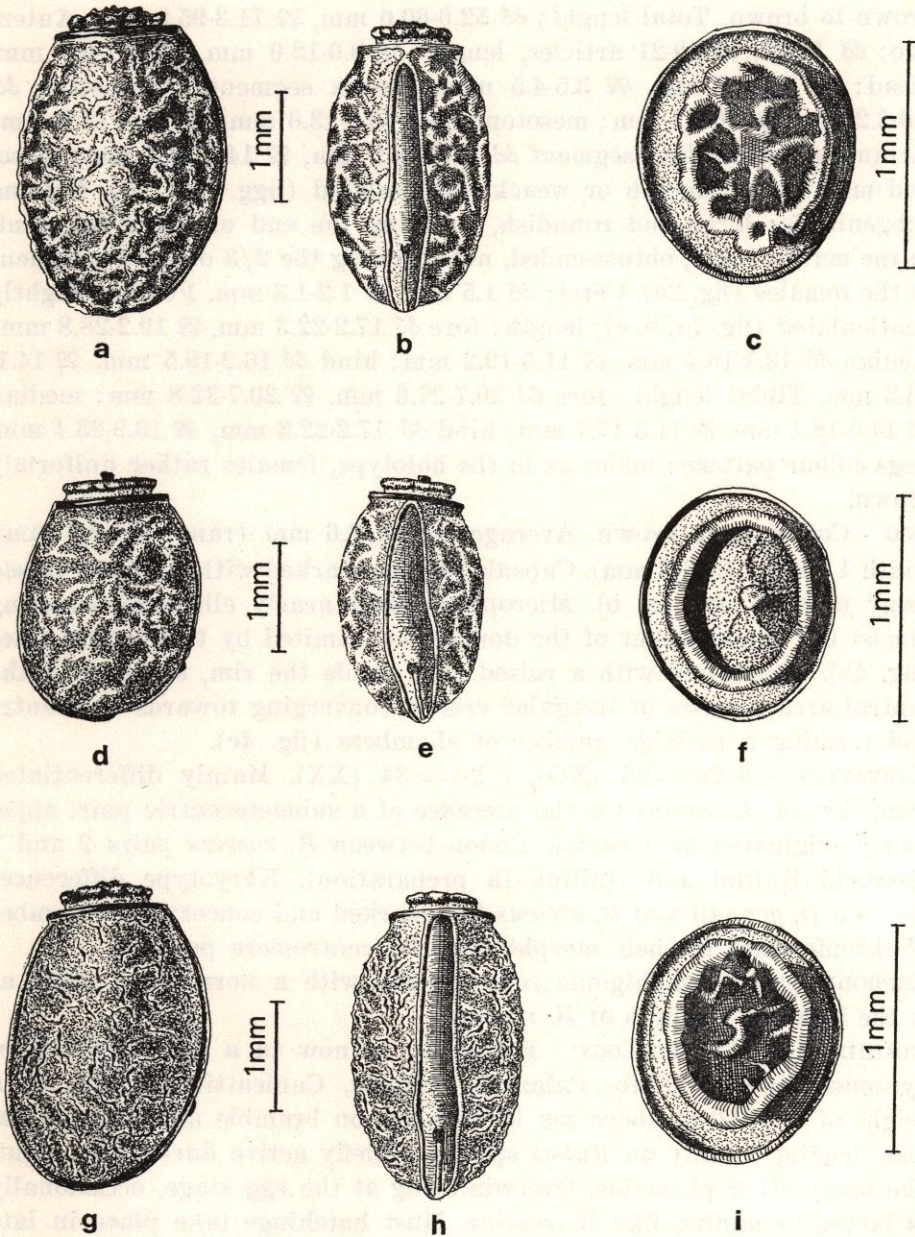


FIG. IV

Egg of *Bacillus grandit* (top row), *B. rossius* (central row) and *B. whitei* (bottom row);  
a, d, g: lateral view; b, e, h: dorsal view; c, f, i: operculum, external surface.

a disruptive colour pattern due to whitish and blackish contiguous areas,

the former ones in the proximal parts of tibiae and tarsi, the latter ones in the subproximal and distal parts of tibiae (fig. 3b).

PARATYPES DESCRIPTION - All adults. Colour: males brown, females light brown to brown. Total length; ♂♂ 52.0-60.0 mm, ♀♀ 71.3-95.8 mm. Antennae; ♂♂ 18-21, ♀♀ 19-21 articles, length ♂♂ 9.0-12.0 mm, ♀♀ 6.1-9.3 mm. Head: ♂♂ 2.5-2.7 mm, ♀♀ 3.5-4.5 mm. Thorax segments: pronotum ♂♂ 2.0-2.2 mm, ♀♀ 3.0-4.1 mm; mesonotum ♂♂ 10.8-13.0 mm, ♀♀ 13.2-17.9 mm; metanotum + median segment ♂♂ 11.0-13.2 mm, ♀♀ 14.1-18.7 mm; meso- and metathorax smooth or weakly granulated (figg. 6 b, 7d). Lamina subgenitalis: large and roundish, reaching the end of the 9<sup>o</sup> segment, in the males; short, obtuse-ended, not reaching the 2/3 of the 9<sup>o</sup> segment in the females (fig. 2a). Cerci: ♂♂ 1.5 mm, ♀♀ 1.2-1.3 mm. Femora slightly denticulated (fig. 7a, b, c); length: fore ♂♂ 17.2-22.3 mm, ♀♀ 19.2-28.8 mm; median ♂♂ 13.1-16.4 mm, ♀♀ 11.5-19.2 mm; hind ♂♂ 16.2-19.5 mm, ♀♀ 14.1-23.5 mm. Tibiae length: fore ♂♂ 20.7-27.6 mm, ♀♀ 20.7-32.8 mm; median ♂♂ 14.0-18.1 mm, ♀♀ 11.3-17.7 mm; hind ♂♂ 17.2-22.3 mm, ♀♀ 13.9-23.4 mm. Legs colour pattern: males as in the holotype, females rather uniformly brown.

EGG - Colour dark brown. Average length 2.6 mm (range 2.4-2.8 mm), width 1.7 mm (1.6-1.8 mm). Capsule surface marked with a clearly raised ridgy pattern (fig. 4a, b). Micropylar plate nearly elliptical, covering almost the whole length of the dorsal face, limited by two lateral lines (fig. 4b). Operculum with a raised ring inside the rim, showing in the central area a series of irregular cristae converging towards the centre and forming a variable number of chambers (fig. 4c).

KARYOTYPE - ♂  $2n = 33$  (XO), ♀  $2n = 34$  (XX). Mainly differentiated from that of *B. rossius* for the presence of a submetacentric pair, apparently originated by a centric fusion between *B. rossius* pairs 2 and 7 (Bianchi Bullini and Bullini, in preparation). Karyotype differences between *B. grandii* and *B. atticus* less marked and concerning a number of chromosomes in their morphology and centromere position.

REPRODUCTION - Amphigonic reproduction with a normal sex-ratio, as in the bisexual biotypes of *B. rossius*.

DISTRIBUTION AND ECOLOGY - Found up to now in a few localities of Syracuse district (Noto, Palazzolo Acreide, Canicattini Bagni), at a height of 200-600 m above sea level. Lives on bramble and other Rosaceae, feeding mainly on *Rubus* species. Chiefly active during the night, like many other phasmids. Overwintering at the egg stage, occasionally as larvae or adults, like *B. rossius*. Most hatchings take place in late spring. Adults generally survive up to the beginning of winter.

DERIVATIO NOMINIS - The species is named in honour and memory of Professor Guido Grandi, the foremost Italian entomologist of our time.

*Bacillus whitei* n. sp.

**MATERIAL EXAMINED** - Holotype ♀, surroundings of Floridia (Syracuse), October 8, 1981, G. Nascetti leg. Preserved in the collection of the Civic Natural History Museum « Giacomo Doria » in Genoa. Paratypes: 10 ♀♀ from the type locality (October 6-8, 1981, G. Nascetti leg.). Preserved in the collections of the Civic Natural History Museums in Genoa (4 ♀♀), Milan (3 ♀♀) and Verona (3 ♀♀). Other material examined: 34 ♀♀ collected on 1980 and 1981 in various localities of Southern Sicily: Lentini, m 50, Floridia, m 100, Syracuse, m 20, Cassaro, m 570, Canicattini Bagni, m 360, Noto, m 150, Palazzolo Acreide, m 670, Raguse, m 500, from May to November.

**DIAGNOSTIC CHARACTERS** - Differentiated from *B. rossius*, *B. grandii* and *B. atticus* for the size and/or shape of lamina subgenitalis and cerci (fig. 2b), for the capsule sculpturing and operculum morphology of the egg (fig. 4g, h, i), for the karyotype (see below).

**HOLOTYPE DESCRIPTION** - Adult female (fig. 5b); colour light brown. Total length 87.6 mm; 21 articles antennae, 8.3 mm long. Head 4.0 mm long. Thorax segments: pronotum 3.8 mm, mesonotum 17.2 mm, metanotum + median segment 17.0 mm; meso- and metathorax weakly granulated. Lamina subgenitalis tapered-shaped, obtuse-ended, almost reaching the end of the 9° segment. Cerci 1.5 mm long. Femora slightly denticulated; length: fore 23.1 mm, median 15.3 mm, hind 18.4 mm. Tibiae length: fore 23.1 mm, median 14.2 mm, hind 18.3 mm. Legs colour: light brown, as in the rest of the body.

**PARATYPES DESCRIPTION** - All adult females; colour light brown to brown or green. Total length: 76.0-90.1 mm. Antennae: 20-22 articles, 6.4-8.3 mm long. Head: 3.8-4.1 mm long. Thorax segments: pronotum 3.5-4.0 mm, mesonotum 14.1-17.5 mm, metanotum + median segment 14.8-17.9 mm. Meso- and metathorax weakly granulated (fig. 8b, 9d). Lamina subgenitalis tapered-shaped, obtuse-ended, almost reaching the end of the 9° segment (fig. 2b). Cerci 1.4-1.5 mm long. Femora denticulation variably developed (fig. 9a, b, c); length: fore 20.0-24.3 mm, median 12.6-16.5 mm, hind 15.7-20.1 mm. Tibiae length: fore 21.1-26.8 mm, median 11.9-15.2 mm, hind 14.7-20.6 mm. Legs colour: as in the rest of the body.

**EGG** - Colour dark brown. Average length 2.9 mm (range 2.8-3.0 mm), width 1.8 (1.7-1.8 mm). Capsule surface with slightly raised ridges (fig. 4g, h). Micropylar plate nearly elliptical, covering the whole length of the dorsal face, limited by a raised ridge (fig. 4h). Operculum with a raised ring inside the rim; irregularly developed cristae, generally not delimiting chambers, in the central area (fig. 4i).

**KARYOTYPE** - ♀  $2n = 35$ , apparently combining the haploid complements of *B. grandii* and *B. rossius* (Bianchi Bullini and Bullini, in preparation).

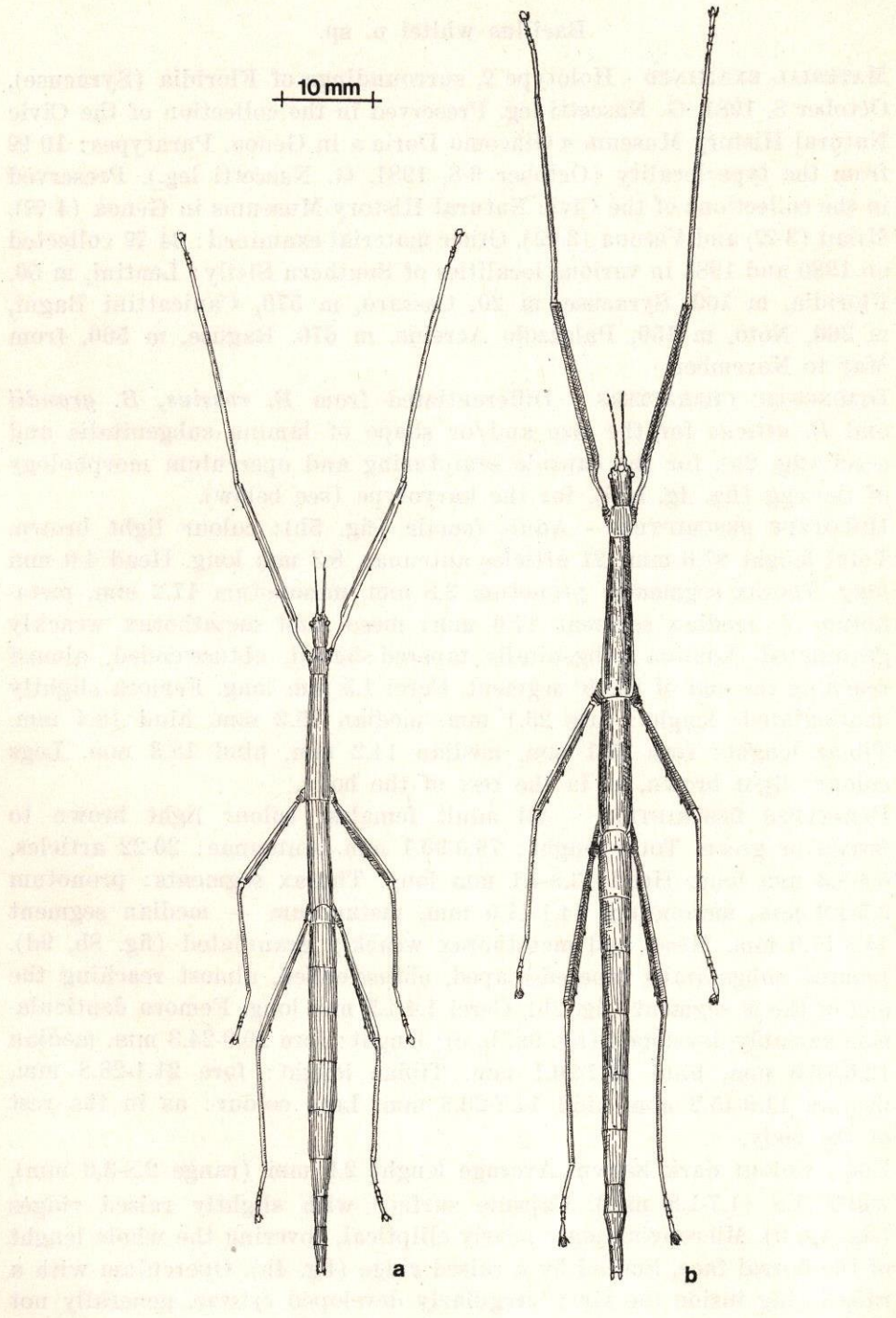


FIG. V  
*a*: *Bacillus grandii* from Noto (Sicily): adult female, dorsal view; *b*: *B. whitei* from Floridia (Sicily): adult female, dorsal view.



REPRODUCTION - By thelytokous parthenogenesis; no males recorded up to now.

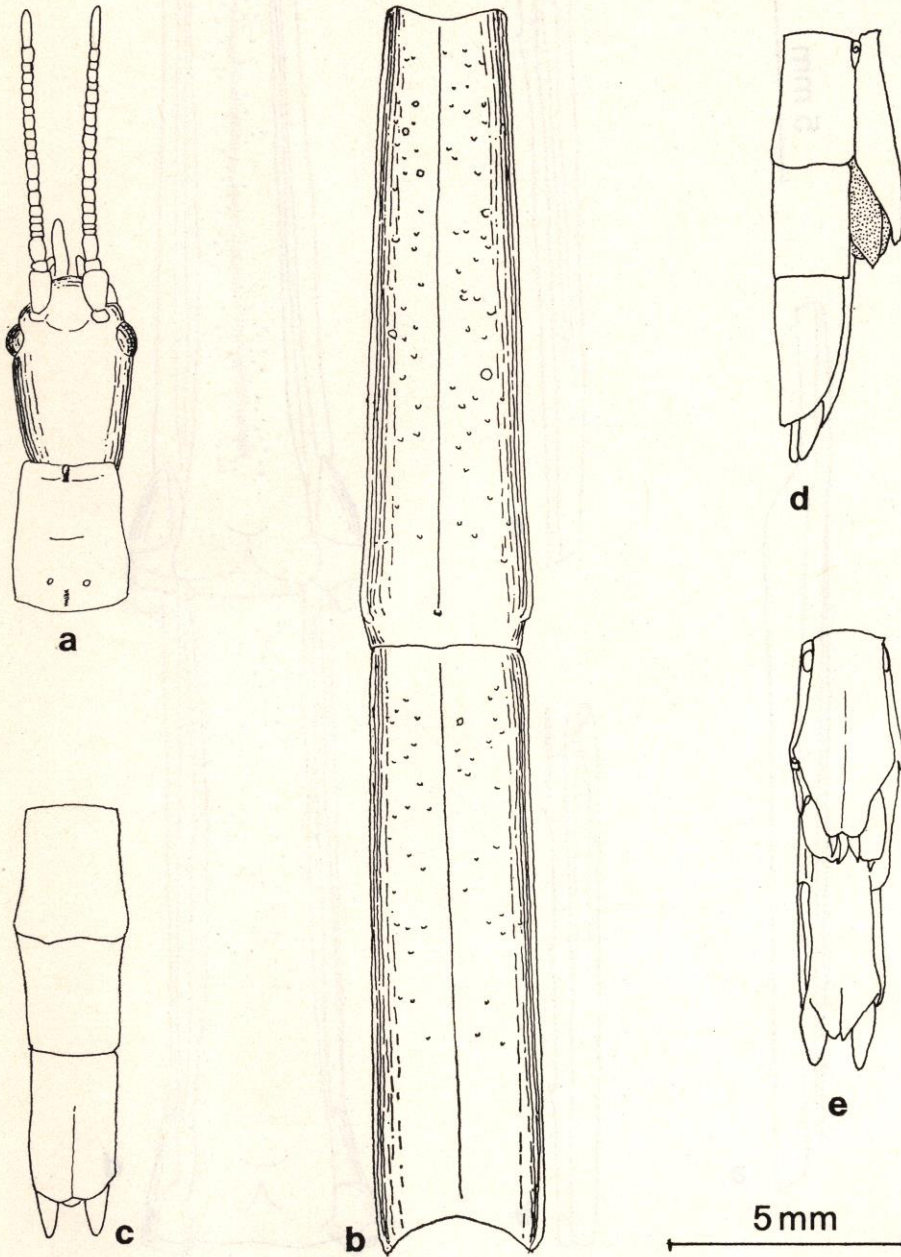


FIG. VI

*Bacillus grandii* from Noto (Sicily); adult female: *a*, head and pronotum, in dorsal view; *b*, meso- and metanotum; *c*, end of abdomen, in dorsal view; *d*, end of abdomen, in lateral view; *e*, end of abdomen, in ventral view.

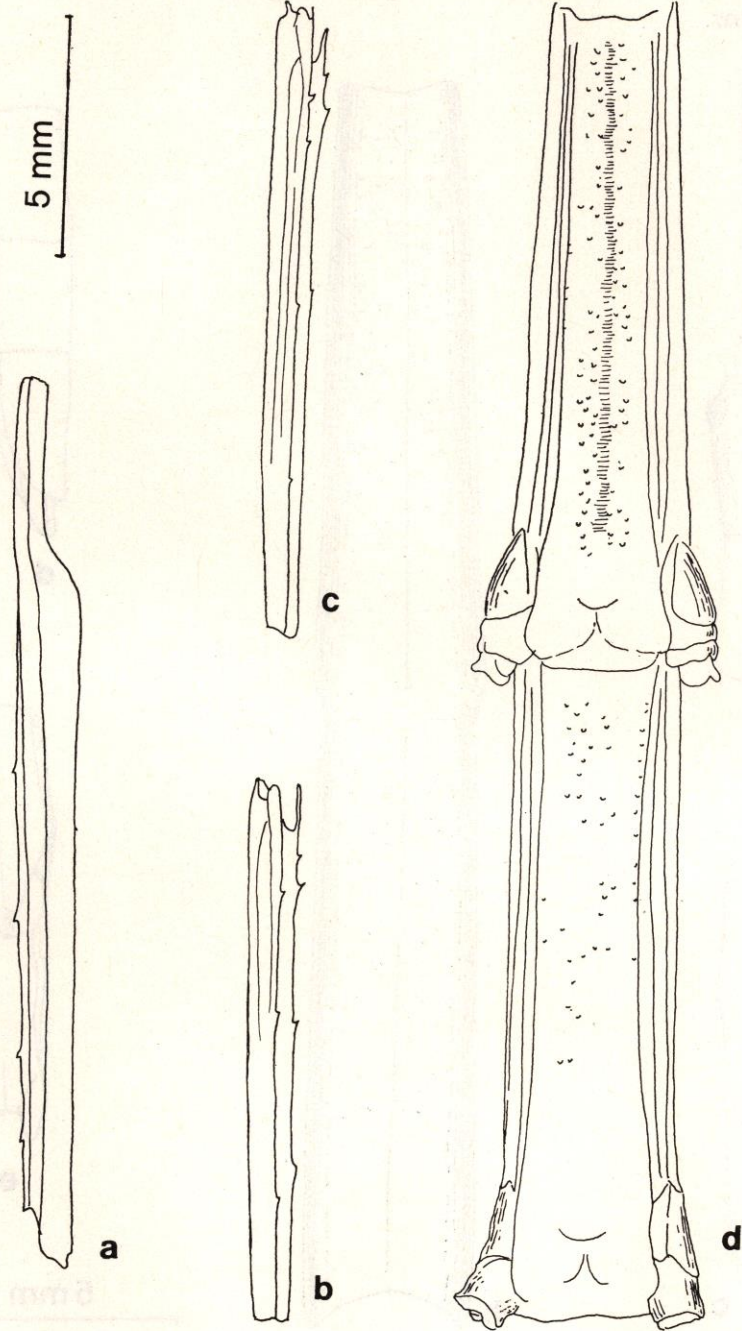


FIG. VII

*Bacillus grandii* from Noto (Sicily); adult female: *a*, left fore femur, in lateral-ventral view; *b*, left median femur, in lateral-ventral view; *c*, left hind femur, in lateral-ventral view; *d*, meso- and metasternum.

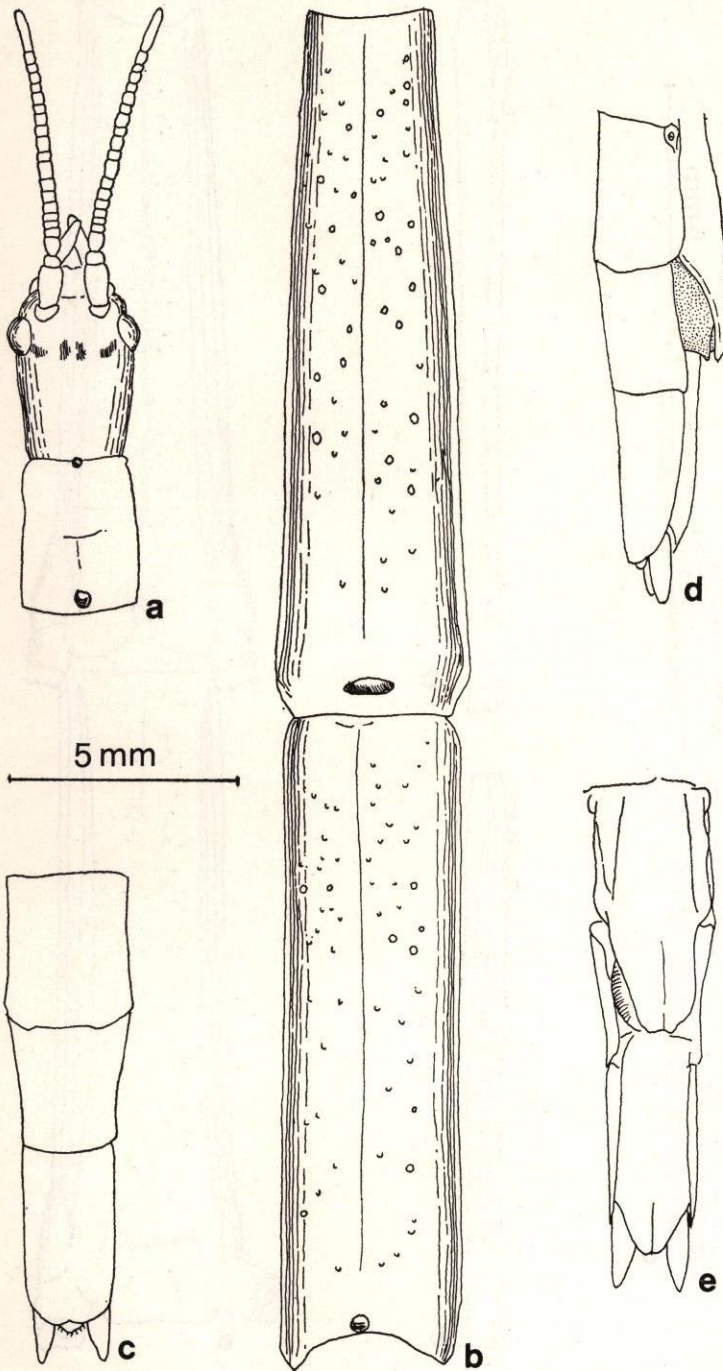


FIG. VIII

*Bacillus whitei* from Florida (Sicily), adult female: *a*, head and pronotum, in dorsal view; *b*, meso- and metanotum; *c*, end of abdomen, in dorsal view; *d*, end of abdomen, in lateral view; *e*, end of abdomen, in ventral view.

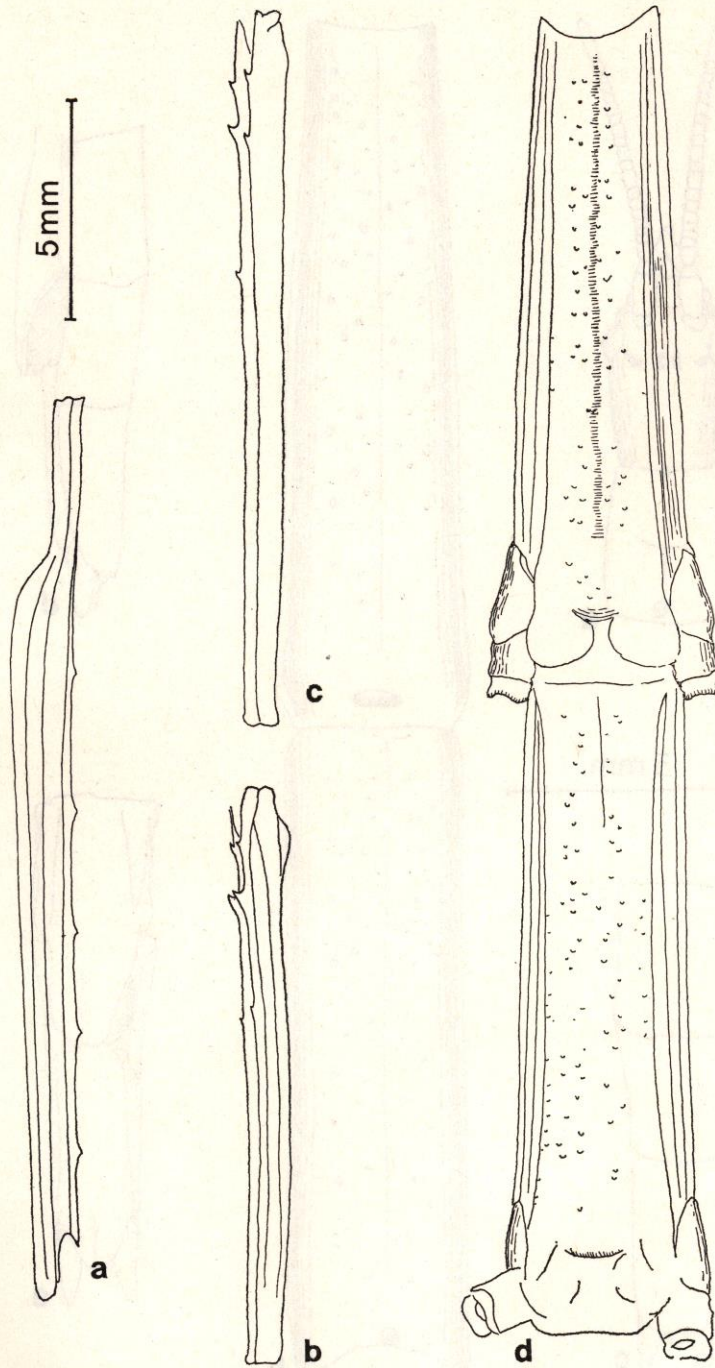


FIG. IX

*Bacillus whitei* from Floridia (Sicily); adult female: *a*, right fore femur, in lateral-ventral view; *b*, right median femur, in lateral-ventral view; *c*, left hind femur, in lateral-ventral view; *d*, meso- and metasternum.

**DISTRIBUTION AND ECOLOGY** - Found in Syracuse and Raguse districts (Southern Sicily); lives from 0 to 700 m above sea level, feeding on *Rubus*. Active during the night. As in *B. grandii*, larvae hatch in late spring, from overwintering eggs (occasionally in autumn, from eggs laid in summer); adults generally survive up to the beginning of winter.

**DERIVATIO NOMINIS** - The species is named in honour of Professor Michael J. D. White, in recognition of his outstanding contribution to the modern evolutionary genetics.

#### DISCUSSION

The origin and evolution of *B. grandii* and *B. whitei* appear to be strongly different, as indicated by their modes of reproduction and their karyotypes.

*B. grandii*, well differentiated from *B. rossius* and the other bisexual *Bacillus* species, is more related to the thelytokous *B. atticus* and *B. whitei*, as shown both by egg and adult morphology and by chromosome data. On the other hand *B. whitei* apparently combines the haploid complements of *B. grandii* and *B. rossius*, also showing a number of intermediate characters between these two species at the morphological level. These evidences suggest a hybrid origin of *B. whitei*, its bisexual ancestors being *B. grandii* and *B. rossius*. According to this hypothesis the shift to thelytoky took place after hybridization, allowing the hybrids reproduction.

By taking advantage from the doubled reproductive potential attained through thelytoky and from the high heterosis due to its hybrid origin, *B. whitei* successfully competed with its bisexual ancestors and reduced their ranges, that are no more overlapping at present in Sicily.

The hypothesis of *B. whitei* origin through hybridization between *B. grandii* and *B. rossius* is strongly supported by recent research on the genetic structure of these species, carried out in our laboratory by means of the electrophoretic analysis of various gene-enzyme systems (Nascetti and Bullini, in preparation).

#### ACKNOWLEDGMENTS

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#### ABSTRACT

Two new phasmids from Sicily, *Bacillus grandii* n. sp. and *B. whitei* n. sp. are described. The former is a bisexual species apparently confined to a few localities in

Syracuse district; the latter is a thelytokous species, spread in Southern Sicily (Syracuse and Raguse districts).

The hypothesis of *B. whitei* origin through hybridization between *B. grandii* and *B. rossius*, followed by a shift to thelytoky allowing hybrids reproduction, is discussed.

*Bacillus grandii* e *B. whitei*, due specie nuove della Sicilia  
(Cheleutoptera, Bacillidae).

RIASSUNTO

Vengono descritti due fasmidi nuovi per la scienza: *Bacillus grandii* n. sp. e *B. whitei* n. sp., recentemente rinvenuti in Sicilia. *B. grandii* è una specie anfigonica con rapporto sessi normale, apparentemente confinata in alcune località della provincia di Siracusa. *B. whitei* si riproduce invece per partenogenesi telitoca (non sono stati finora osservati maschi); risulta diffusa in ampie zone della Sicilia meridionale, nelle provincie di Siracusa e Ragusa.

Viene discussa l'ipotesi che *B. whitei* si sia originato per ibridazione di *B. grandii* e *B. rossius*, seguita dall'instaurarsi della telitochia, che ha consentito la riproduzione indefinita della specie ibrida.

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