

Class

Actinobacteria

Subclass

Actinobacteridae

Order

Actinomycetales

Suborder

Micromonosporineae

Family

Micromonosporaceae

Genus

Micromonospora

The Genus Micromonospora

To the genus *Micromonospora* belong 28 species *Micromonospora aurantiaca*, *auratinigra*, *carbonacea*, *chalcea*, *chersinia*, *citrea*, *coerulea*, *eburnea*, *echinaurantiaca*, *echinofusca*, *echinospora*, *endolithica*, *fulviviridis*, *gallica*, *halophytica*, *inositola*, *inyoensis*, *matsumotoense*, *mirobrigensis*, *nigra*, *olivasterospora*, *pallida*, *peucetia*, *purpureochromogenes*, *rosaria*, *sagamiensis*, *siamensis* and *viridifaciens*.

Well-developed, branched, septate mycelium averages 0,5 µm in diameter. Nonmotile spores are borne singly, sessile, or on short or long sporophores that often occur in branched clusters. Sporophore development is monopodial or in some cases sympodial. Aerial mycelium is absent or in some cultures appears irregularly as a restricted white or grayish bloom.

Walls contain meso-diaminopimelic acid (meso-DAP) and/or its 3-hydroxy derivative and glycine. Xylose and arabinose are present in cell hydrolysates. Characteristic phospholipids are phosphatidylethanolamine, phosphatidylinositol, and phosphatidylinositol mannosides. Major menaquinones are MK-9(H₄), MK-10(H₄), MK-10(H₆), or MK-12(H₆). Iso- and anteiso-branched fatty acids predominant. The main fatty acids are 15 : 0 iso, 15 : 0 anteiso, 16 : 0 iso, 16 : 0, 17 : 0 iso, 17 : 0 anteiso, 17 : 1 cis 9, 17 : 0, 18 : 1 cis 9 and 18 : 0.

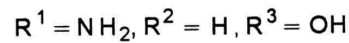
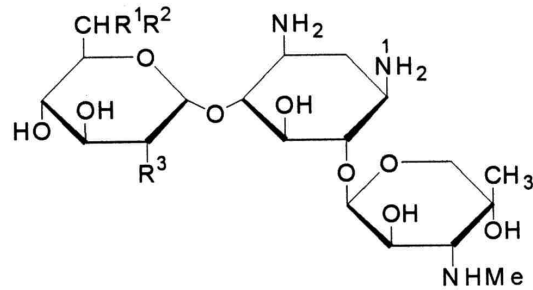
Aerobic to microaerobic. Growth occurs normally at 20-40°C but not above 50°C. Inhabit soil, water, marine environment, and sediments. A few strains, anaerobic and of uncertain taxonomy, have been reported in the intestinal tract of termites and the rumen of sheep.

Type species is *Micromonospora chalcea*.

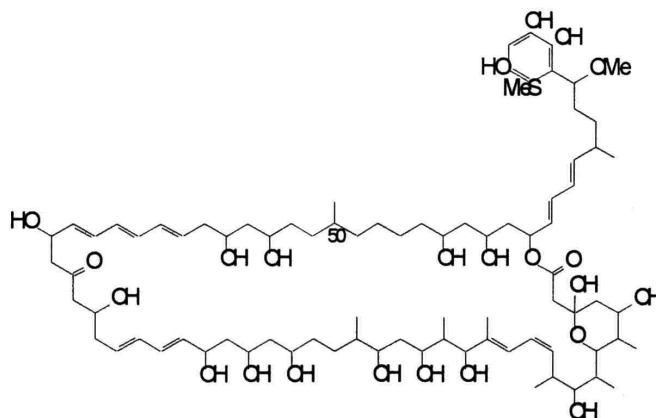
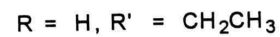
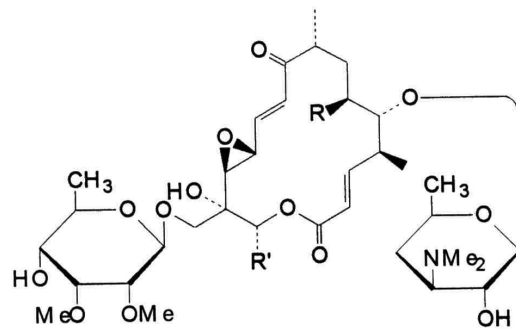
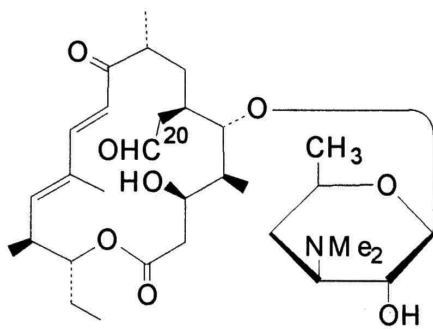
Lit.: Oerskov, J. 1923.
Investigations into the morphology of the Ray Fungi.
Levine and Munksgaard, Copenhagen, Denmark

Secondary metabolites of *Micromonospora* species

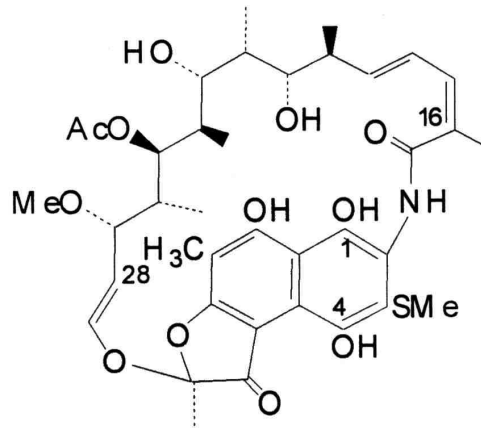
Gentamicin B, aminoglycoside antibiotic with broad spectrum antibacterial activity and clinical use



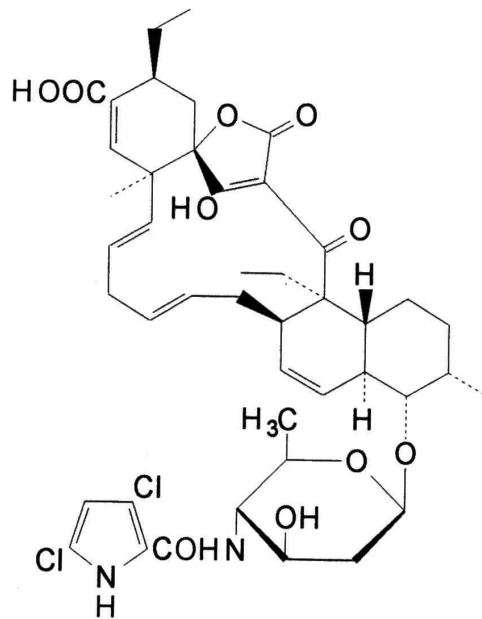
Macrolide antibiotics like Repromycin (upper/left) active against gram-positive bacteria, Mycinamycin (upper/right) active against gram-positive bacteria and Quinolidomycin (lower) cytotoxic



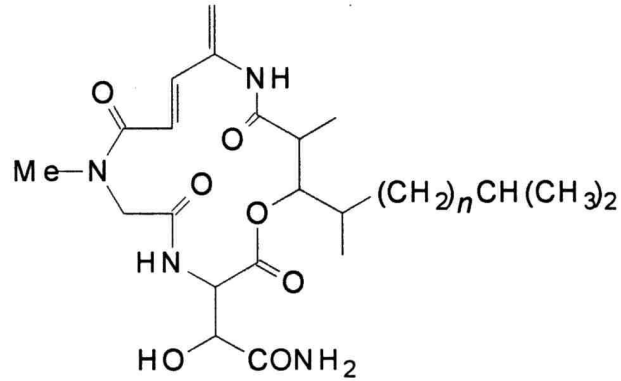
3-(Methylthio)rifamycin, ansamycin type antibiotic, active against gram-positive bacteria



Antitumor agent BMY 42448

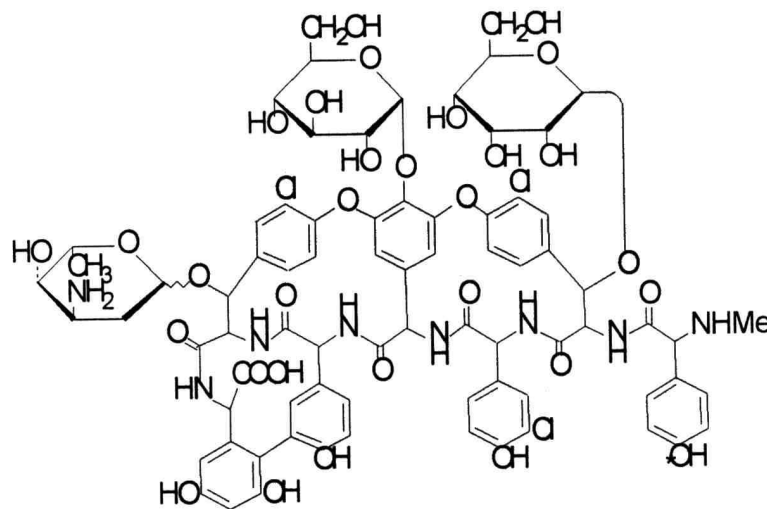


Rakicidin A, lipopeptide antibiotic, cytotoxic agent



$$n = 11$$

Chloropolysporin C, glycopeptide antibiotic, animal growth promoter, active against gram-positive bacteria



The genus *Micromonospora*

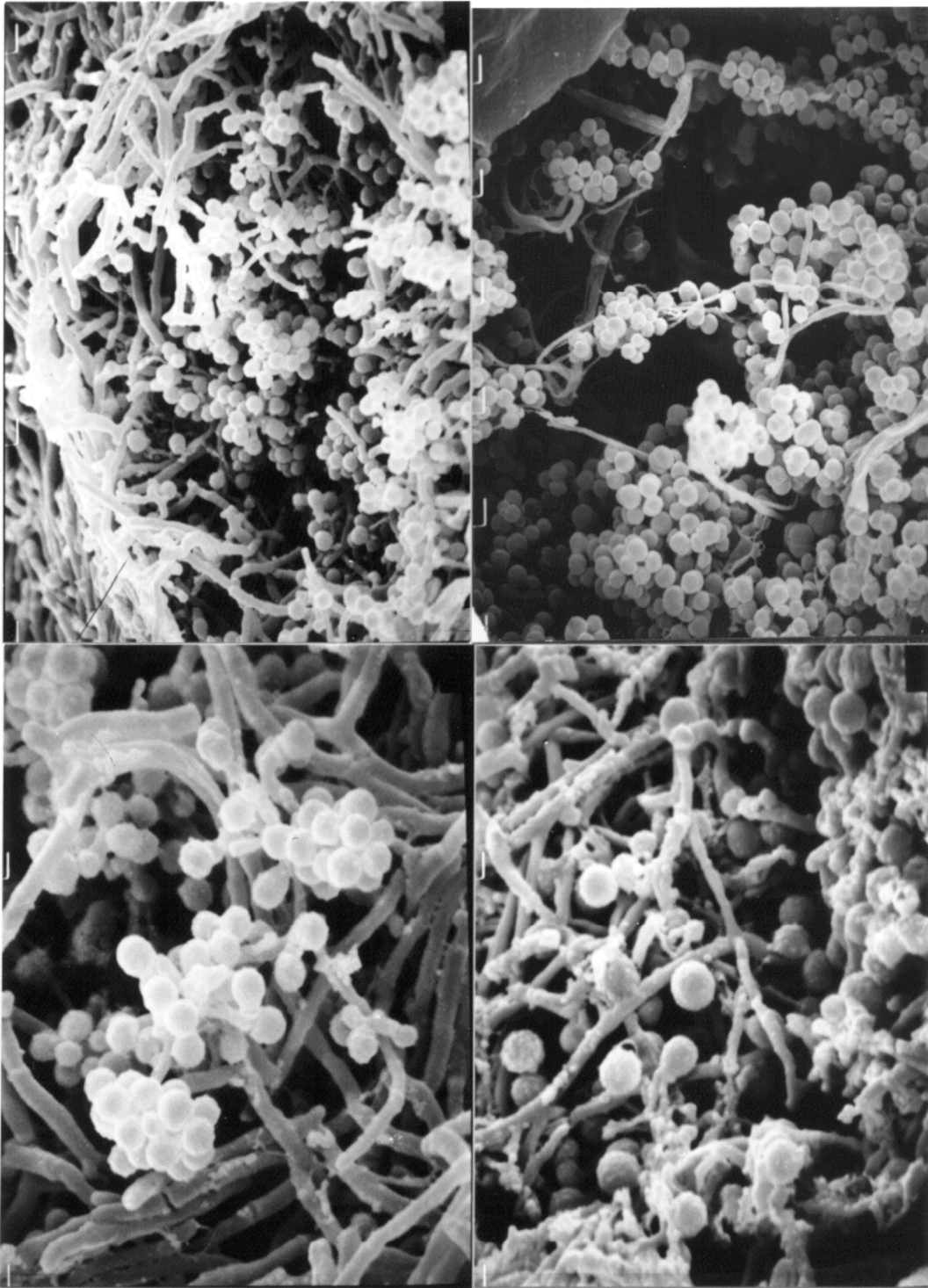
M. carbonacea
M. chalcea
M. chersinia

M. coerulea
M. echinospora
M. inositola

M. olivasterospora
M. purpurea
M. purpureochromogenes

Medium 5006 (upper)
Medium 5265 (lower)

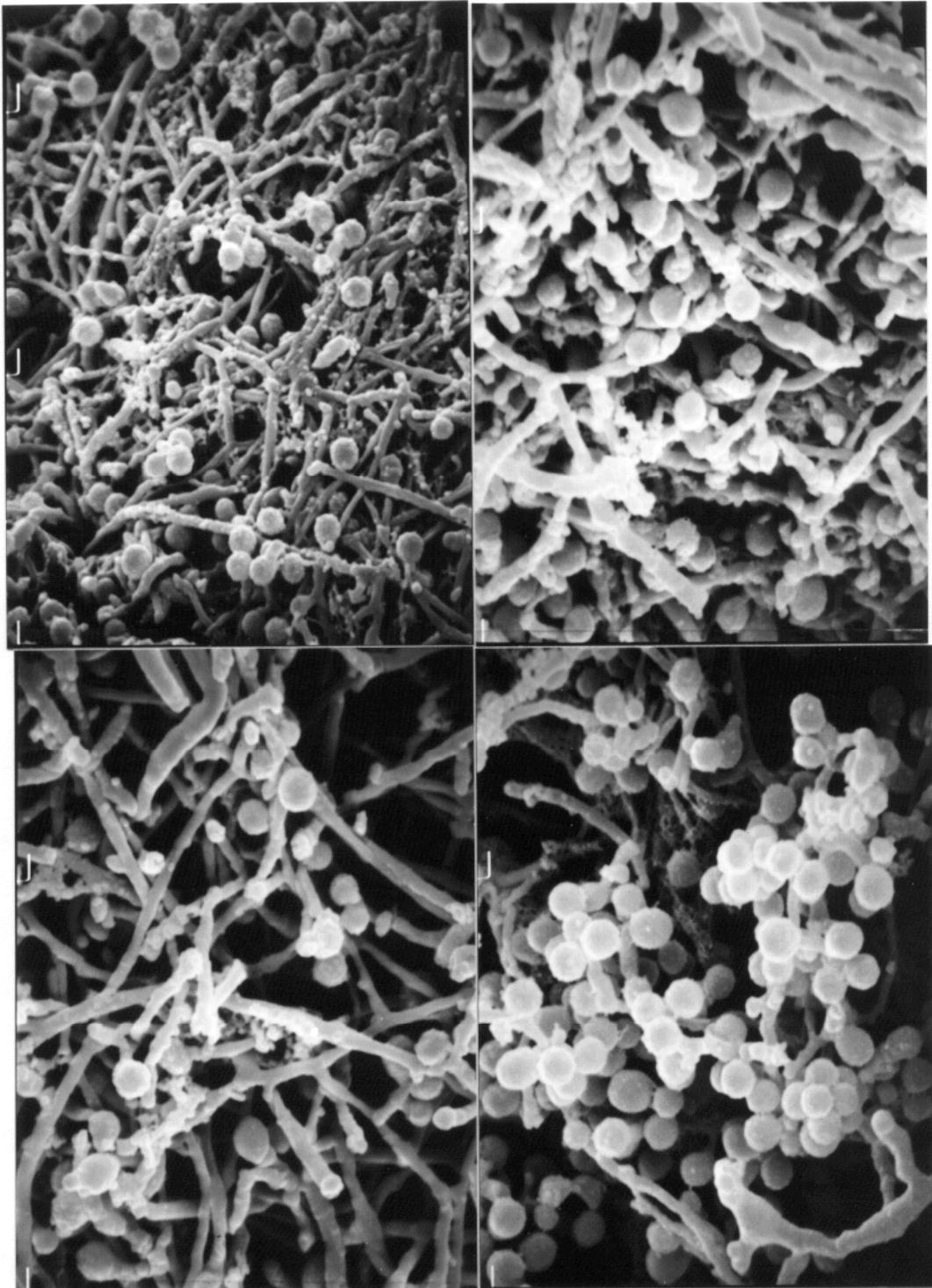




The single spores of *Micromonospora* species isolated from soil in Scanning Electron Microscopy I

Magnification: A and B x 3.500

C and D x 7.500



The single spores of *Micromonospora* species isolated from soil in Scanning Electron Microscopy II

Magnification: A x 5.000 B - D x 7.500

Genus Identity Card

Genus	<i>Micromonospora</i>
Wall chemotype	meso-DAP, glycine (type II)
Whole cell sugar pattern	xylose, arabinose (type D)
Fatty acid pattern	iso C 15:0, iso C 16:0, C 17:1, 10 methyl C 17:0
Major menaquinone (MK)	-9(H ₄), 10(H ₄)
Phospholipidtype	phosphatidylethanolamine, phosphatidylinositol, phosphatidylinositol mannoside
Mol% G+C of DNA	71-73
Morphology	branched substrate mycelium, single spores sessile or on a short or long sporophore
Type species	<i>Micromonospora chalcea</i>

***Micromonospora olivasterospora* Kawamoto et al. 1983**

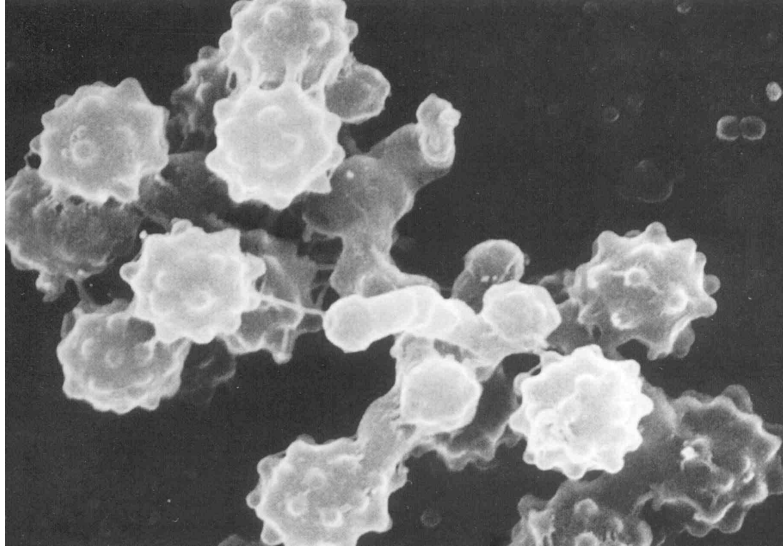


Photo by S. Kinoshita, K. Ochiai & K. Ando in the Atlas of Actinomycetes 1997 (The Society of Actinomycetes, Japan).

Name: MICROMONOSPORA
Authors: Oerskov 1923
Status: Approved Lists
Type species: *M. chalcea*
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)

Name: *Micromonospora aurantiaca*
Authors: Sveshnikova et al. 1969
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27029, DSM 43813, IMET 8216

Name: *Micromonospora auratinigra*
Authors: Thawai et al. 2004
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 54:1425
Risk group: 1 (German classification)
Type strain: DSM 44815, JCM 12357

Name: *Micromonospora brunnea*
Authors: Sveshnikova et al. 1969
Status: Heterotypic Synonym
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Comment: synonymy: IJSB 34:463*; IJSEM 50:131*
Type strain: ATCC 27334, DSM 43814, IMET 8304
Synonym: *Micromonospora purpureochromogenes*

Name: *Micromonospora carbonacea*
Authors: Luedemann and Brodsky 1965
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27114, DSM 43168, NRRL 2972

Name: *Micromonospora carbonacea* subsp. *aurantiaca*
Authors: Luedemann and Brodsky 1965
Status: Approved Lists, Previously Subspecies
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27115, DSM 43815

Synonym: *Micromonospora carbonacea*
Name: *Micromonospora carbonacea* subsp. *carbonacea*
Authors: Luedemann and Brodsky 1965
Status: Approved Lists, Previously Subspecies
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27114, DSM 43168, NRRL 2972
Synonym: *Micromonospora carbonacea*

Name: ***Micromonospora chalcea* (Type species)**
Authors: (Foulerton 1905) Orskov 1923
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 12452, CBS 269.62, DSM 43026,
IFO 13503, IMET 8209

Name: *Micromonospora chersina*
Authors: Tomita et al. 1992
Status: New Species
Literature: Int. J. Syst. Bacteriol. 42:656 (validation list)
Risk group: 1 (German classification)
Type strain: ATCC 53710, DSM 44151, M956-1

Name: *Micromonospora citrea*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 35571, CIP 108947, DSM 43903,
KCC A-0256

Name: *Micromonospora coerulea*
Authors: Jensen 1932
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27008, DSM 43143, IFO 13504,
IMET 8210

Name: *Micromonospora eburnea*
Authors: Thawai et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:421
Risk group: 1 (German classification)
Type strain: DSM 44814, JCM 12345, PCU 238

Name: *Micromonospora echinoaurantiaca*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 35572, CIP 108948, DSM 43904, KCC A-0257, NBRC 14022

Name: *Micromonospora echinofusca*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: CIP 108946, DSM 43913, IFO 14267, NBRC 14267

Name: *Micromonospora echinospora*
Authors: Luedemann and Brodsky 1964 emend. Kasai et al. 2000
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Comment: emended description: IJSEM 50:131*
Type strain: ATCC 15837, DSM 43816
Synonyms: *Micromonospora purpurea* (heterotypic synonym), *Micromonospora rhodorangea* (heterotypic synonym)

Name: *Micromonospora echinospora* subsp. *echinospora*
Authors: Luedemann and Brodsky 1964
Status: Approved Lists, Previously Subspecies
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 15837, DSM 43816
Synonym: *Micromonospora echinospora*

Name: *Micromonospora echinospora* subsp. *ferruginea*
Authors: Luedemann and Brodsky 1964
Status: Approved Lists, Previously Subspecies
Literature: Int. J. Syst. Bacteriol. 30:321 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 15836, DSM 43141, NRRL 2995
Synonym: *Micromonospora echinospora*

Name: *Micromonospora echinospora* subsp. *pallida*
Authors: Luedemann and Brodsky 1964
Status: Basonym
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 15838, DSM 43817
Synonym: *Micromonospora pallida*

Name: *Micromonospora endolithica*
Authors: Hirsch et al. 2004
Status: New Species
Literature: Int. J. Syst. Bacteriol. 54:631 (validation list)
Risk group: 1 (German classification)
Type strain: AA-459, DSM 44398, NRRL B-24248,
DSM 44398

Name: *Micromonospora fulviviridis*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 35574, CIP 108952, DSM 43906,
NRRL B-16104

Name: *Micromonospora gallica*
Authors: (Erikson 1935) Waksman 1961
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Comment: cited erroneously as synonym of *Streptomyces yerevanensis* until April 1994 in DSM List
Type strain: NCTC 4582

- Name: *Micromonospora halophytica*
Authors: Weinstein et al. 1968
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: DSM 43171
- Name: *Micromonospora halophytica* subsp. *halophytica*
Authors: Weinstein et al. 1968
Status: Approved Lists, Previously Subspecies
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27596, DSM 43171, NRRL 2998
Synonym: *Micromonospora halophytica*
- Name: *Micromonospora halophytica* subsp. *nigra*
Authors: Weinstein et al. 1968
Status: Basonym
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 33088, DSM 43818
Synonym: *Micromonospora nigra*
- Name: *Micromonospora inositola*
Authors: Kawamoto et al. 1974
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 21773, DSM 43819
- Name: *Micromonospora inyonensis*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 27600, CIP 108951, DSM 46123, KCC A-0188, JCM 3188

Name: *Micromonospora matsumotoense*
Authors: (Asano et al. 1989) Lee et al. 2000
Status: New Combination
Literature: Int. J. Syst. Bacteriol. 50:3 (validation list)
Risk group: 1 (German classification)
Type strain: 6393-C, DSM 44100, IFO 14550
Synonyms: *Catellatospora matsumotoense* (basonym)

Name: *Micromonospora mirobringensis*
Authors: Trujillo et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:879
Risk group: 1 (German classification)
Type strain: DSM 44830, LMG 22229

Name: *Micromonospora nigra*
Authors: (Weinstein et al. 1968) Kasai et al. 2000
Status: New Combination
Literature: Int. J. Syst. Bacteriol. 50:131
Risk group: 1 (German classification)
Type strain: ATCC 33088, DSM 43818
Synonyms: *Micromonospora halophytica* subsp. *nigra* (basonym)

Name: *Micromonospora olivasterospora*
Authors: Kawamoto et al. 1983
Status: New Species
Literature: Int. J. Syst. Bacteriol. 33:110
Risk group: 1 (German classification)
Type strain: ATCC 21819, DSM 43868, MK70

Name: *Micromonospora pallida*
Authors: (Luedemann and Brodsky 1964) Kasai et al. 2000
Status: New Combination
Literature: Int. J. Syst. Bacteriol. 50:131
Risk group: 1 (German classification)
Type strain: ATCC 15838, DSM 43817
Synonyms: *Micromonospora echinospora* subsp. *pallida* (basonym)

- Name: *Micromonospora peucetia*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: SM 43363, JCM 12820
- Name: *Micromonospora purpurea*
Authors: Luedemann and Brodsky 1964
Status: Heterotypic Synonym
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Comment: synonymy: IJSEM 50:131*
Type strain: ATCC 15835, CBS 648.71, DSM 43036, IFO 12575, IMET 8212, NRRL 2953
Synonym: *Micromonospora echinospora*
- Name: *Micromonospora purpureochromogenes*
Authors: (Waksman and Curtis 1916) Luedemann 1971
Status: Approved Lists
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Type strain: ATCC 27007, DSM 43821, IMET 8213
Synonyms: *Micromonospora brunnea* (heterotypic synonym)
- Name: *Micromonospora rhodorangea*
Authors: Wagman et al. 1974
Status: Heterotypic Synonym
Literature: Int. J. Syst. Bacteriol. 30:322 (AL)
Risk group: 1 (German classification)
Comment: synonymy: IJSEM 50:131*
Type strain: ATCC 27932, DSM 1039, NRRL 5326
Synonym: *Micromonospora echinospora*
- Name: *Micromonospora rosaria*
Authors: Horan and Brodsky 1986
Status: New Species
Literature: Int. J. Syst. Bacteriol. 36:478
Risk group: 1 (German classification)
Type strain: 67694, ATCC 29337, DSM 803, NRRL 3718, SCC 957

Name: *Micromonospora sagamiensis*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 21826, CIP 108950, DSM 43912,
KCC A-0310, NRRL 11334

Name: *Micromonospora siamensis*
Authors: Thawai et al. 2006
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 56:2
Risk group: 1 (German classification)
Type strain:

Name: *Micromonospora viridifaciens*
Authors: Kroppenstedt et al. 2005
Status: New species
Literature: Int. J. Syst. Evol. Microbiol. 55:1743
Risk group: 1 (German classification)
Type strain: ATCC 31146, CIP 108949, DSM 43909

Genus *Micromonospora*
Species *chalcea*
Subspecies
Author (Foulerton 1905) Orskov 1923

Reclassification

Status Approved Lists

Type species ATCC 12452, DSM 43026, IFO 13503,
IMET 8209

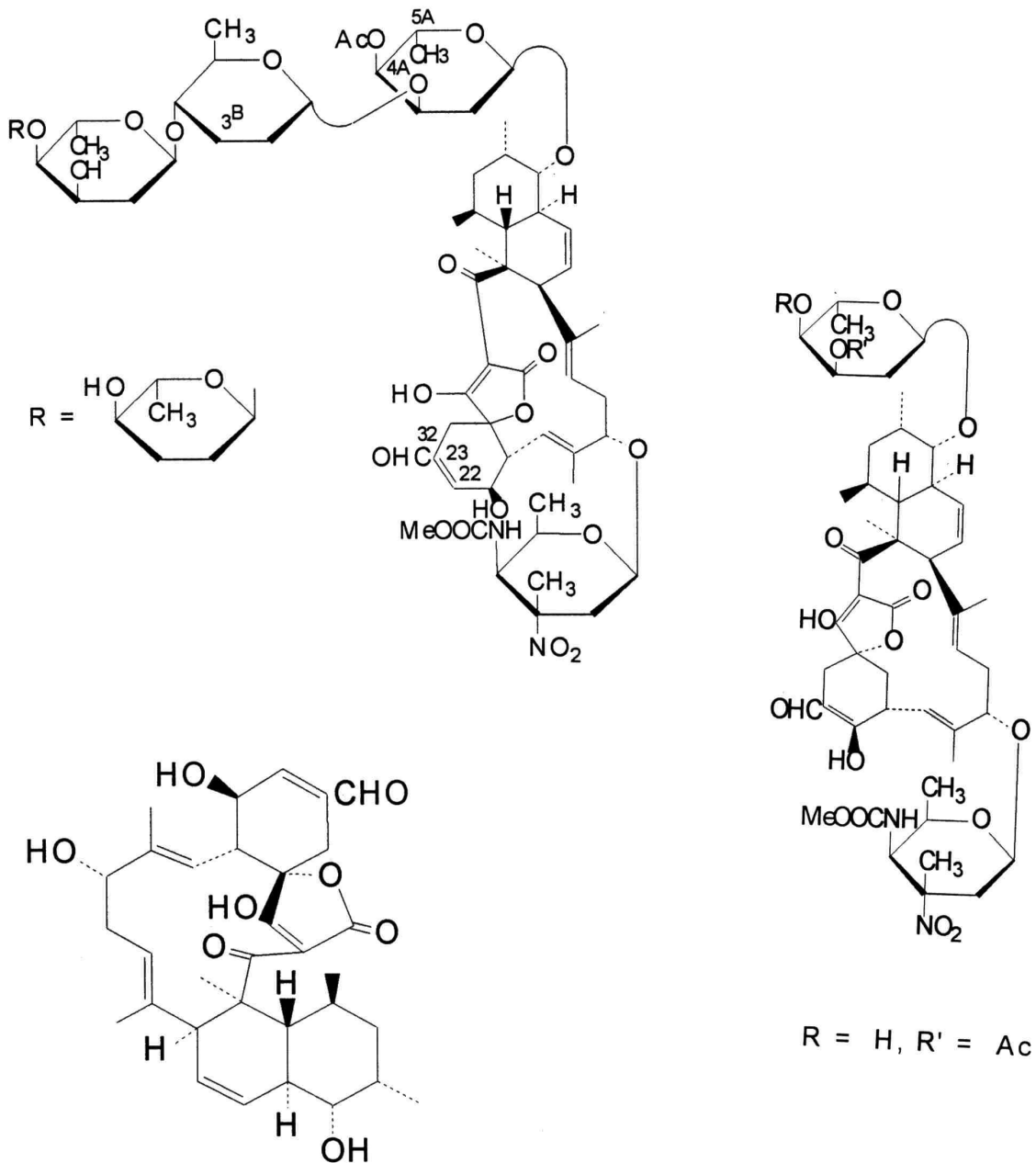
Hazard group 1

Fatty acid pattern:

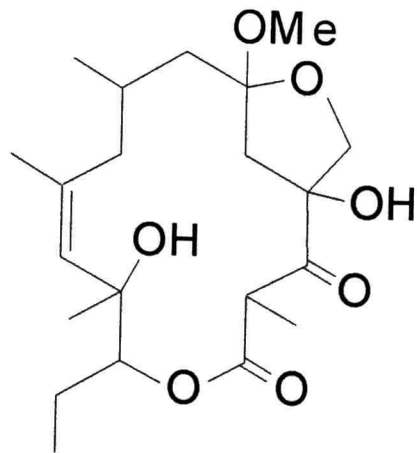
14 : 0 Iso	2,0	17 : 0	12,0
15 : 0 Iso	17,0	17 : 0 10methyl	8,0
15 : 0 Anteiso	9,0	18 : 1 cis 9	2,0
15 : 0	2,0	18 : 0	6,0
16 : 0 Iso	12,0		
16 : 0	4,0		
16 : 0 10methyl	2,0		
17 : 0 Iso	6,0		
17 : 0 Anteiso	12,0		
17 : 1 cis 9	4,0		

Secondary metabolites from *Micromonospora chalcea*

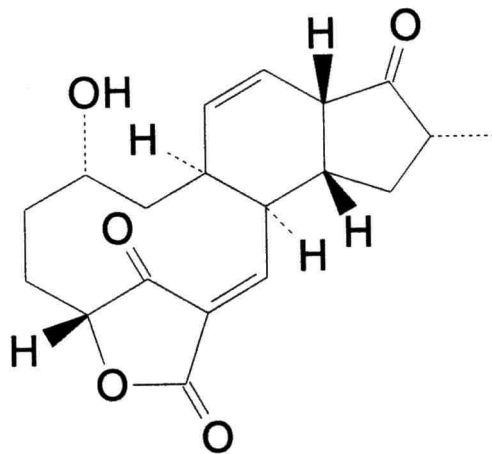
Tetrocarcin A and E antitumor and antimalaria agents, active against gram positive bacteria, and Tetronolide the aglycon of Tetrocarcin



Neorustmicin B, macrolide antibiotic with antifungal activity



Macquarimicin A, cytotoxic agent



Genus: *Micromonospora*

FH 2171

Species: *chalcea*

Numbers in other collections: ATCC 12452

Morphology:

	G	R
<u>ISP 2</u>	good	red orange
	A	SP
	none	none
	G	R
<u>ISP 3</u>	good	orange
	A	SP
	none	none
	G	R
<u>ISP 4</u>	good	bright orange
	A	SP
	none	none
	G	R
<u>ISP 5</u>	good	bright orange
	A	SP
	white	none
	G	R
<u>ISP 6</u>	sparse	red orange
	A	SP
	none	none
	G	R
<u>ISP 7</u>	good	bright orange
	A	SP
	none	none

Spore chains:

Spore surface: smooth

Sporangia:

Fragmentation:

Melanoid pigment: - - - -

NaCl resistance: 2,5 %

Lysozyme resistance:

pH: Value- Optimum-

Temperature : Value- Optimum- 28 °C

Carbon utilization:

Glu	Ara	Suc	Xyl	Ino	Man	Fru	Rha	Raf	Cel
+	+	+	-	-	-	+	-	+	-

Enzymes:

Gel	Cit	Ure	Arg	Onp	Trp	Lys	Odc	VP	Ind	H ₂ S
+	+	+	+	-	-	+	+	+	-	-
2+	3+	4+	5-	6+	7+	8+	9+	10+	11+	12+
13+	14+	15(+)	16+	17(+)	18+	19-	20-			



Micromonospora chalcea

A – Agar plates medium 5265, 5315, 5317 and 5323

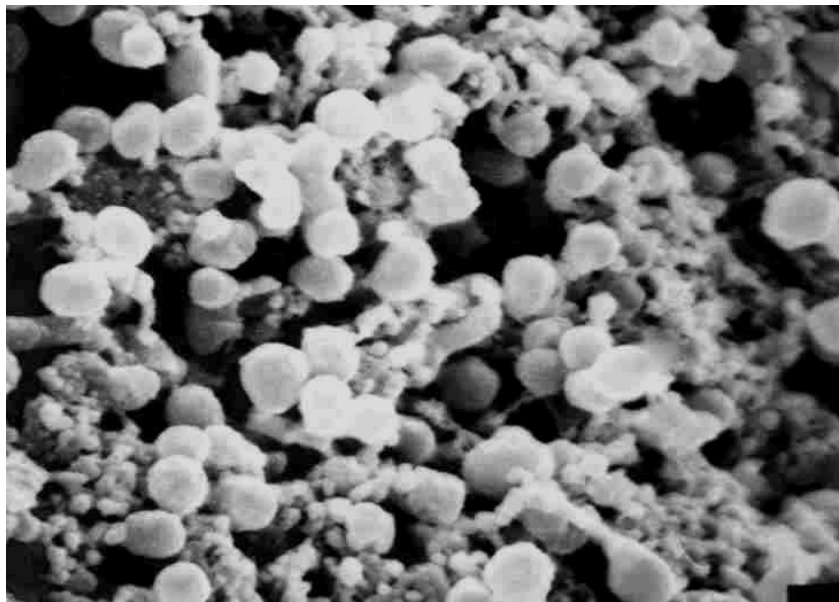
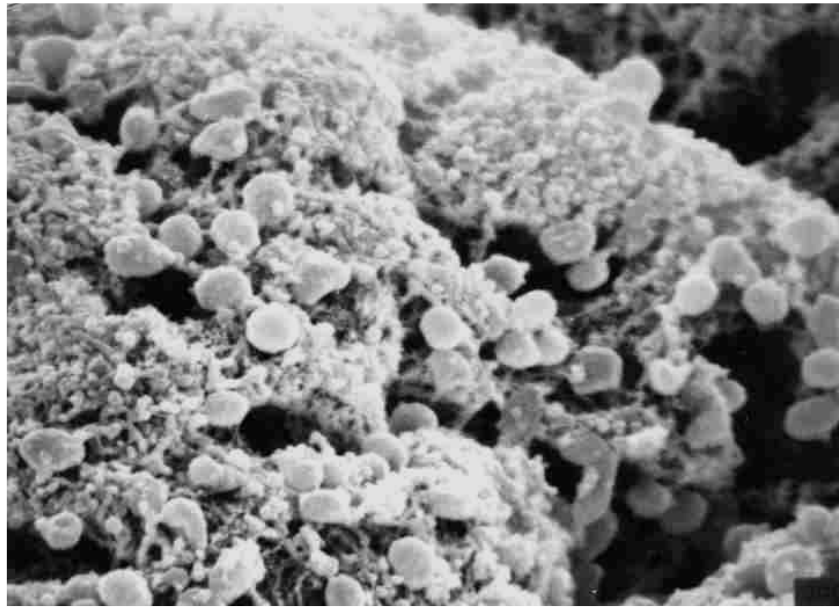
B – Agar plates medium 5006, 5318, 5322, 5337 with and without tyrosine



Micromonospora chalcea

C – Colony detail on medium 5265

D – Microplate for carbon utilization



Micromonospora chalcea

Spore formation in SEM

E x 7.500 F x 10.000