MALDI-TOF MS
Identification of dermatophytes

- Dermatophytes
- Overview literature
- Routine use MALDI-TOF MS in dermatophyte identification

Dermatophytes

- Invasion and infection of keratinized tissues
- Three anamorphic genera: *Epidermophyton*, *Microsporum* and *Trichophyton*
- Geophilic, zoophilic and anthropophilic species (natural habitat)
- Treatment cost – half a billion dollars annually USA(*)
- Resistance to treatment is uncommon
- Proper identification: critical for treatment regime and detection of inoculum source

*Graser, Y., J. Scott, and R. Summerbell. 2008. The new species concept in dermatophytes-a polyphasic approach. Mycopathologia 166:239-256.

Classical identification (ID)

- Correlation of clinical manifestations of infection and observation of macro- and microscopic properties

  experienced technologists, morphological characteristics

  sterile mycelium (antifungal treatment)

- DNA sequence-based ID (gold standard)

  expensive and time-consuming

Both restricted by slow growth of dermatophytes (up to 3 weeks)

MALDI-TOF MS identification

ID dermatophytes:

- **Improve accuracy**
- **Decrease analysis time**

Overview literature

Int. J. Mol. Sci. 2014, 15, 16912-16924; doi:10.3390/ijms150916012

OPEN ACCESS
International Journal of
Molecular Sciences

isp wiv

Article

JCM
Journals.ASM.org

Mycopathologia (2015) 180:165–171
DOI 10.1007/s11046-015-9898-x

CrossMark

Evaluation of the Bruker Matrix-Assisted Laser Desorption–Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) System for the Identification of Clinically Important Dermatophyte Species

Nilgün Karabıçak · Onur Karatuna · Macit İlkit · Işın Akyar

Received: 11 March 2015 / Accepted: 2 May 2015 / Published online: 14 May 2015

Received: 11 July 2014; in revised form: 22 August 2014 / Accepted: 28 August 2014 / Published: 11 September 2014

Technical challenges for routine use

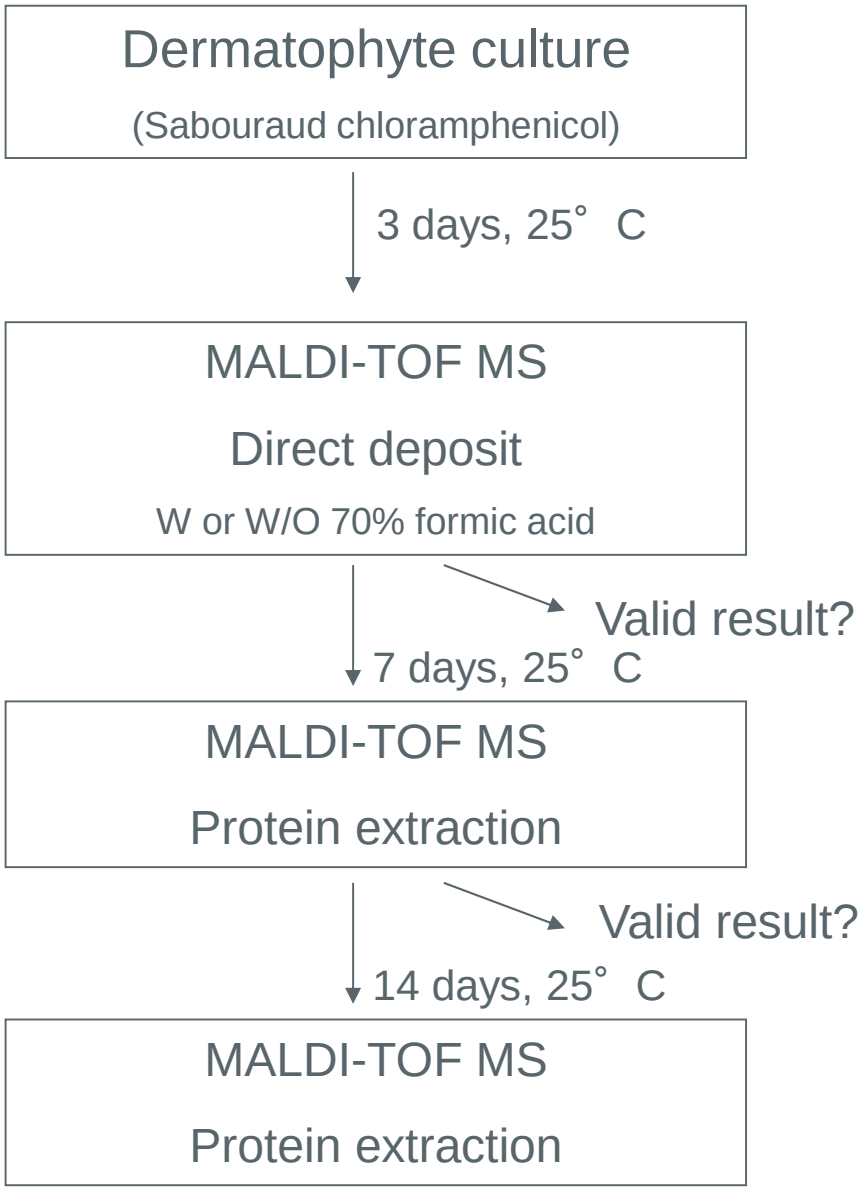
- Growth forms in sample (mycelium or conidia)
- Duration of incubation
- Culture medium
- Preparation methods (solid or liquid)
- Amount of biomass
- Type of instrument used

MALDI-TOF MS system	Author, year	Method	Result
Andromas	Alshawa *et al*., 2012	• ref. db – 12 sp. 50 isolates • 3w inc. direct + FA	91.9% correct ID
AnagnosTec SARAMIS software	Erhard *et al.*, 2007	• ref. db – 18 sp. • 4w inc. direct	99.9% correct ID (not: closely related sp.)
	Nenoff *et al.*, 2013	• ref. db – 21 sp. 285 isolates • at least 1w inc. direct	98.8% correct ID (not: closely related sp.)
	De Respinis *et al.*, 2013	• ref. db – 18 sp. 108 isolates • 3d inc. direct + FA with sample prep	95.8% correct ID (*T. rubrum* complex)
Vitek MS Plus System	De Respinis *et al.*, 2015	• db + extension – 17 sp. 134 isolates • 3d inc. in house sample prep.	95.4% correct ID (*T. rubrum* complex)

MALDI-TOF MS system	Author, year	Method	Result
MALDI Biotyper (Bruker)	Theel *et al*., 2011	• db + extension – 20 spectra • 3d inc. extr.	20.5 vs 59.6% correct species ID
	Packeu *et al.*, 2013	• ref. db – 54 isolates • 12d inc. extr.	*T. menta* complex – 89% correct ID
	l'Ollivier *et al.*, 2013	• ref. db – 17 sp. 48 isolates • 3/6d inc. extr.	97.8% correct ID
	Packeu *et al.*, 2014	• ref. db – 58 sp. 195 isolates • 3/14d inc. direct & extr.	100% correct ID after max. 14d inc.
	Calderaro *et al.*, 2014	• db + extension – 24 spectra • 3w inc.extr.	correct ID after extension of db
	Karabiçak *et al.*, 2015	• extension of db – 10 sp. • 3d inc. extr.	89.7% correct ID (*T. rubrum* complex)

MALDI-TOF MS
Workflow

MALDI-TOF MS Workflow



Packeu, A., De Bel, A.,l'Ollivier, C., Ranque, S., Detandt, M., and Hendrickx, M. 2014.
J Clin Microbiol 52(9): 3440-3.

Fast ID of the infection agent:

- Indication of the source of infection (animal or human)

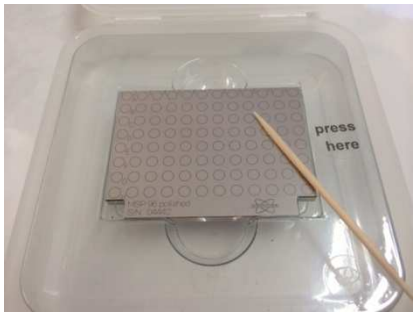
- Indication of the infectivity (proper treatment)

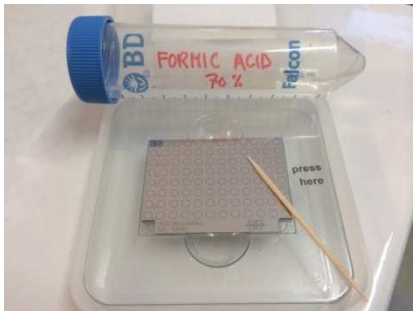
tinea capitis

(children before puberty – epidemic in school environment/family)

Tinea capitis outbreak

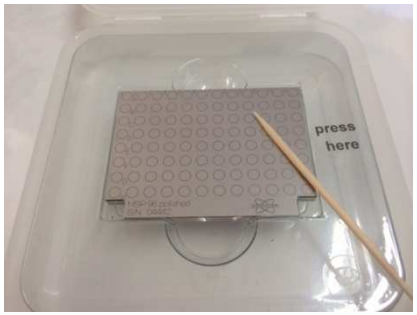
direct deposit, W and W/O 70% formic acid

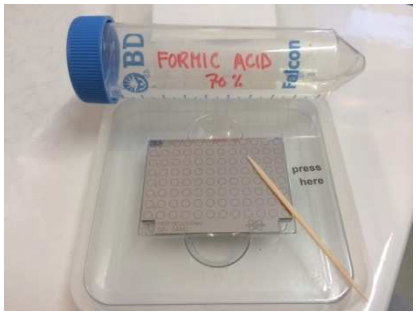




Tinea capitis outbreak

direct deposit, W and W/O 70% formic acid

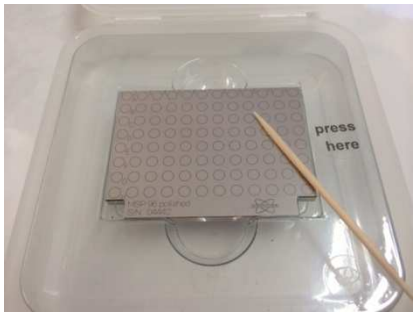


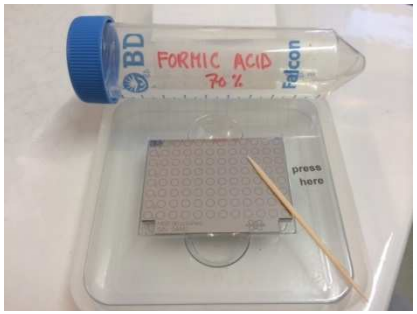


Results after first signs of growth of the dermatophytes (in validation phase)

Tinea capitis outbreak

direct deposit, W and W/O 70% formic acid





Results after first signs of growth of the dermatophytes (in validation phase)

Tinea capitis: early ID of causative agent (ID of source, initiation of a proper treatment and restriction of the outbreak)

Conclusion

PROs:

CONs:

Conclusion

PROs:

- User friendly and robust
- Fast and accurate identification

CONs:

Results dependent

- quality of the database (reference material)
- quality of the sample (growth stage dermatophyte)

Closely related species: difficulty to differentiate

Culture based method

Conclusion

PROs:

- User friendly and robust
- Fast and accurate identification

CONs:

Results dependent

- quality of the database (reference material)
- quality of the sample (growth stage dermatophyte)

Closely related species: difficulty to differentiate

Culture based method

Take into account: clinical, macro- and microscopic features

Acknowledgements

- Section of Mycology and Aerobiology, WIV-ISP Brussels

- A. De Bel, AZ Groeninge and J. Breynaert, University Hospital Brussels

Thank you for your attention!