

*Trichoderma*

\*

( // : // : )

*Trichoderma*

RBSF

DNA

*Trichoderma*

5.8S	ITS1	rDNA	ITS			
	ITS			ITS4	ITS1	ITS2
<b>TrichoKEY 2</b>						

<i>T. hamatum</i>	<i>T. atroviride</i>	<i>T. virens</i>	<i>Trichoderma harzianum</i>
		<i>T. asperellum</i>	<i>brevicompactum</i>
	<i>T. virens</i>	<i>T. harzianum</i>	<i>Trichoderma</i>
	<i>T. harzianum</i>		<i>Trichoderma</i>
		<i>T. virens</i>	
<i>T. atroviride</i>			

*Trichoderma harzianum* ITS :  
*T. virens*

(Kubicek *et al.*, 2003)

- (Druzhinina & Kubicek, 2005) (Druzhinina & Kubicek, 2005)
- (Druzhinina *et al.*, 1998) (Gams & Bissett, 2006) (Harman *et al.*, 2004)
- (Ospina-Giraldo *et al.*, 1999)
- (Kredics *et al.*, 2003) (*Hypocrea*)
- (2003) Bissett *et al.* (Samuels, 2006)
- (2006) Samuels ( ) (Bissett *et al.*, 2003)
- (1969) Rifai
- (Druzhinina & Kubicek, 2005) (2006) Samuels (2005) DNA
- (1984, 1991a-c, Bissett 1992)
- (1969) Rifai
- DNA *Longibrachiatum* *Saturnisporum* *Trichoderma* *Pachybasium* *Hypocreanum*
- (Samuels, 2006)
- Druzhinina *et al.* DNA (2005)
- 
1. Species aggregate  
2. Section

ITS2 ITS1

rDNA

(2004) Craus *et al.*

TrichOKEY 2.0

*T. brevicompactum*

(ISTH) *Hypocrea* *Trichoderma*

(<http://www.isth.info/tools/molkey/index.php>)

TrichOKEY

ITS1

ITS2

(Lewis & Papavizas,

.1991)

( )

(Monte, 2001)

(Samuels,

.2006)

(Harman & Kubicek, 1998)

(Druzhinina & Kubicek, 2005)

*T. reesei*

(Martinez *et al.*, 2008)

*T. atroviride*

(<http://gebine.ugu-psf.org>)

(2002, 2004) Zafari *et al.*

Nazmi Roudsari *et al.*

(2007)

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1. Species-specific

( )  
 °C PDA  
 ( °C)  
 °C  
**DNA**  
 DNA (Davet & Rouxel,  
 GenElute Plant Genomic DNA Miniprep Kit (Sigma, USA) 2000)  
 MgSO<sub>4</sub> / KH<sub>2</sub> PO<sub>4</sub>  
**ITS**  
 rDNA ITS /  
 ITS2 5.8S ITS1  
 (White *et al.*, 1990) ITS4 ITS1  
**PCR**  
 KCl (10X) *Taq* Buffer  
 2 mM 25 mM MgCl<sub>2</sub>  
 / / dNTPs  
*Taq* DNA polymerase  
 DNA  
 (Hermosa *et al.*, 2000) L  
 (Dhingra & Sinclair, 1995)  
 T3 Thermocycler  
 : (Biometra, Germany)  
 °C  
 °C ( ) °C ( ) °C  
 °C ( )  
**PCR**  
 GenElute PCR Clean-up Kit (Sigma, USA)  
 ABI 3730 xl DNA  
 sequencer (Applied Biosystems, USA) °C

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2. Colony forming unit (cfu)/g  
 3. Internal transcribed spacer

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1. Dilution plate

ITS

text

Clustal X 2.0

ITS

*T. hamatum* *T. atroviride*

*T. virens*

PDA

*T. harzianum*

°C

ITS

( )

(EU821780-EU821801)

± °C

*T. atroviride* *T. asperellum*

*T. harzianum* *T. hamatum* *T. brevicompactum*

%

*T. virens*

**Trichoderma asperellum** Samuels, Lieckf. & Nirenberg

(CH-2 )

*Trichoderma* *T. asperellum*

Hamatum Pachybasium A

( / cm)

( )

Gams & (1984, 1991a-c, 1992) Bissett

(1999) Samuels *et al* (1998) Bissett

(2004) Kraus *et al*

TrichoKEY 2

/ / × / /

ITS

× /

( )

1. Accession number

2. Clade

3. Ampuliform

*Trichoderma brevicompactum* Kraus, Kubicek & Gams

*T. brevicompactum*  
Lutea Lone Lineages  
( cm)

***Trichoderma atroviride* Karst**

*Trichoderma* *T. atroviride*  
*H. atroviridis* Viride  
( / cm)

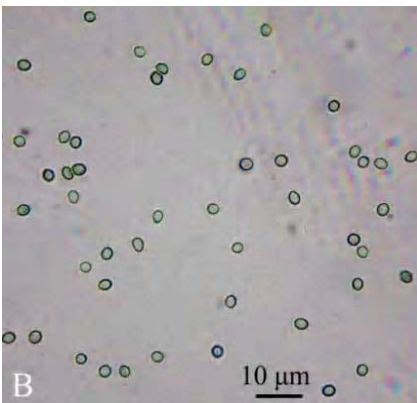
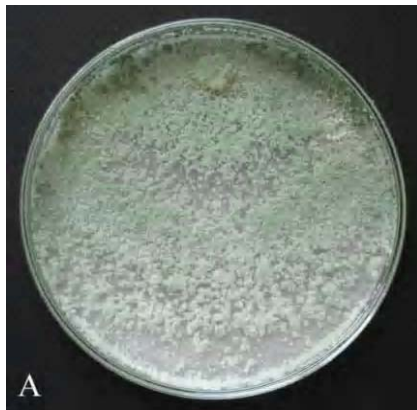
/ x / /

/ / x /

/ x / /

( ) / / x

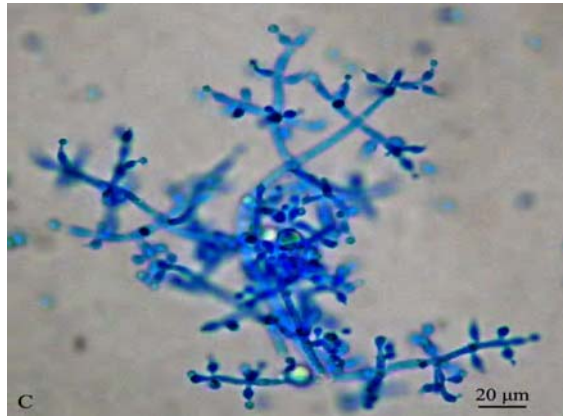
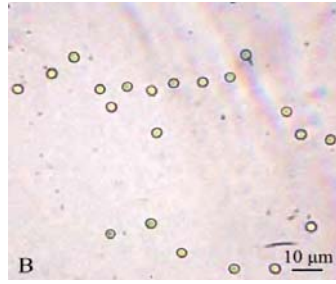
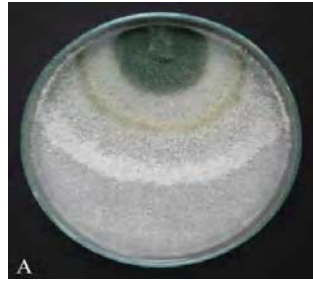
1. Lageniform



*T. asperellum*



(C) (B) (A)



*T. atroviride*

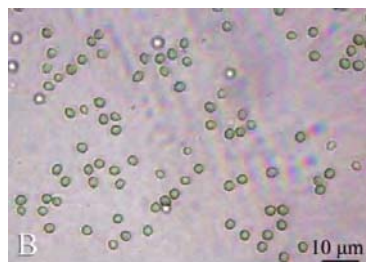
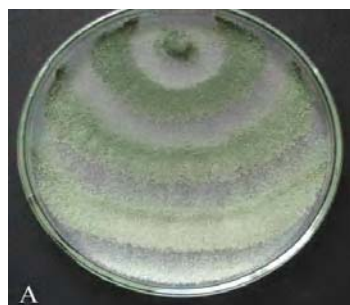
(C)

(B)

(A)

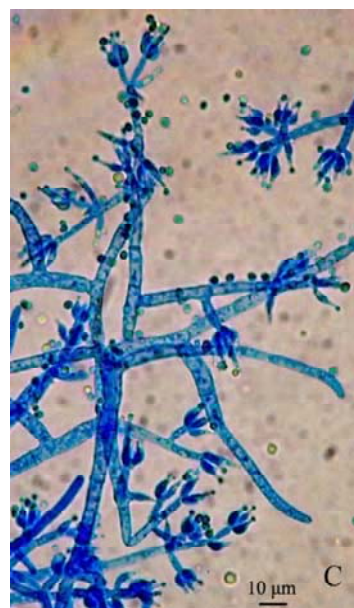
***Trichoderma hamatum* (Bonord.) Bainier**

A *Trichoderma hamatum* Pachybasium  
 Hamatum  
 (. / cm)



*T. brevicompactum*

(C)



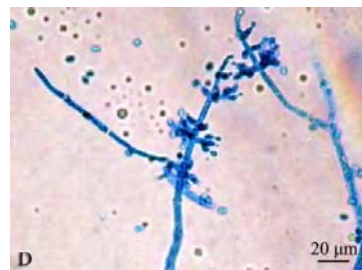
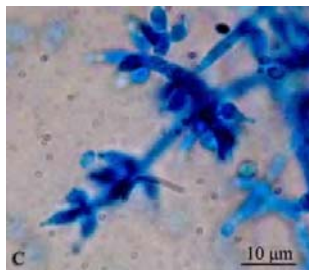
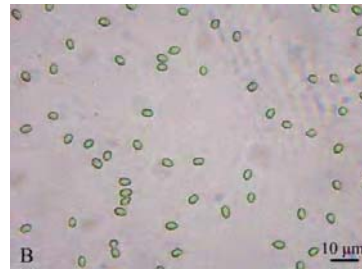
(B)

(A)

| × |

| | × |

( ) |



*T. hamatum*

(D C

(B

(A

***Trichoderma harzianum* Rifai**

*Pachybasium*      *T. harzianum*  
*Hypocrea*      Harzianum  
    *lixii*

| × | |

| | × |

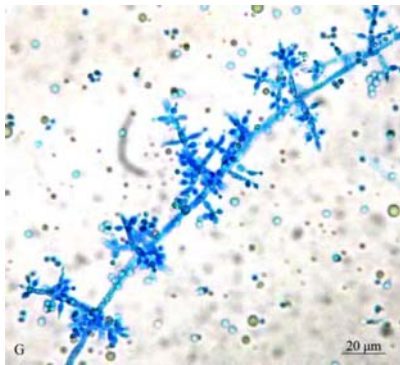
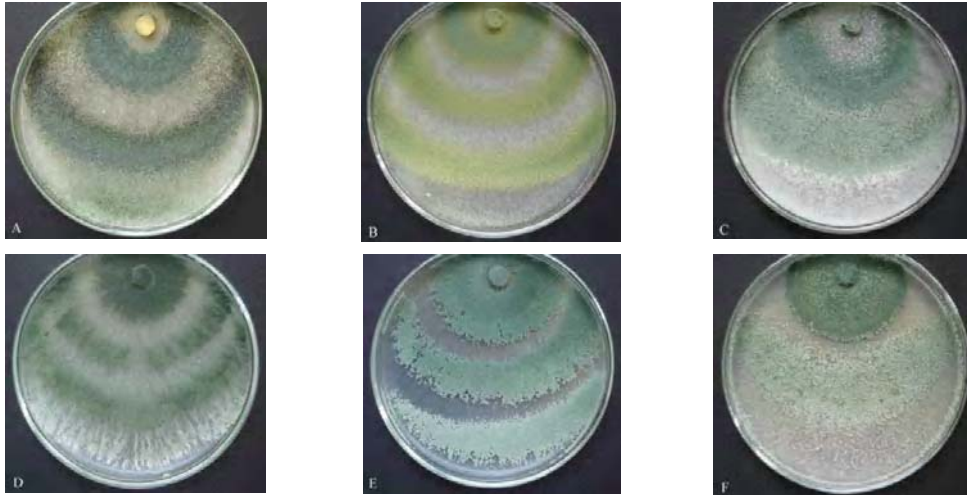
( )

***Trichoderma virens* (Miller, Giddens & Foster) von Arx**

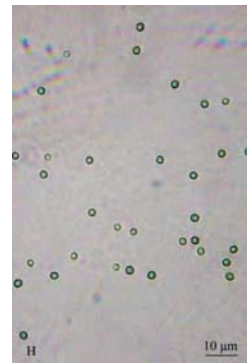
*Pachybasium*      *T. virens*  
    Virens  
    *H. virens*

( cm)

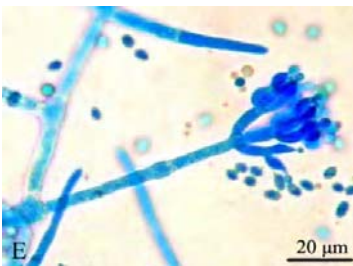




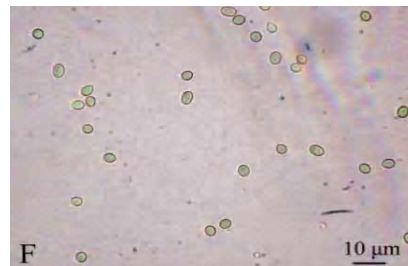
(H) (*T. harzianum*)



(A-F)



(F) (D-E *T. virens*)



(A-C)

$1 \times 10^6$  cfu/g  
 $1 \times 10^7$  cfu/g

$1 \times 10^6$  /

$1 \times 10^6$  /

$1 \times 10^6$  /

( )

(1987) Nagamani & Mew

(Bissett, 1991b)

*T. harzianum*

( )

*T. hamatum* *T. atroviride* *T. asperellum*

*T. brevicompactum*

( )

(2002) Zafari *et al.*

(1995) Mostafa Kamal & Shahjahan

*T. harzianum*

*T. koningii* *T. hamatum*

*T. harzianum*

(2000) Cumagun & Lubeck

*T. harzianum*

*T. harzianum*

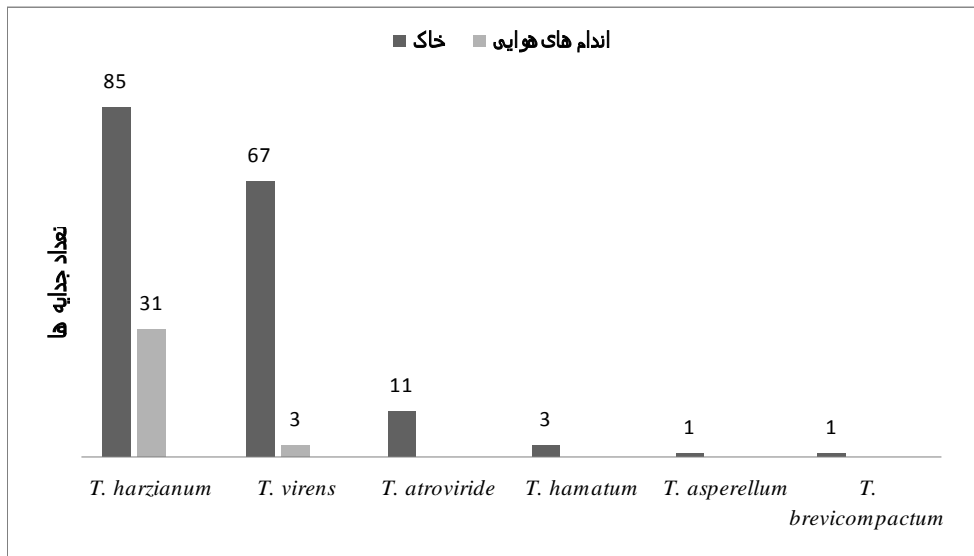
(Rifai, 1969)

( )

ITS

(<http://www.mazandaranmet.ir>)

*T. harzianum*



(2003) Chaverri *et al.*

*T. virens* *T. harzianum*

*T. harzianum*

*T. harzianum* .

( )

*T. virens*

*T. virens*

( )

*T. virens* .

*T. atroviride* .

*T. virens* *T. harzianum*

*Pachybasium*

*Trichoderma*

*T. hamatum*

*T. virens* *T. harzianum*

*T. brevicompactum* *T. asperellum*

1. Species complex

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