ANTIFUNGAL/ANTAGONISTIC ACTIVITY OF DIFFERENT *GANODERMA* COLLECTIONS AGAINST PLANT PATHOGENIC FUNGI AND THEIR ANTAGONISTS

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Introduction

Research on biology of Basidiomycetes mushrooms has markedly increased due to their ability to synthetize bioactive metabolites and potential for the production of different biotech-products used in medicine, pharmaceutical, food and agriculture industries [1,2]. Nowadays, there are no effective mushroom-based biological control products against plant pathogenic fungi. Meanwhile, study of antifungal activity of Basidiomycetes mushroom and their antagonistic effect against plant pathogenic fungi could be of practical interest to develop new bio-control agents applicable in agriculture [3-5].

Fig. 1. Fruiting bodies of studied *Ganoderma* species: *Ganoderma adspersum* (a), *Ganoderma applanatum* (b), *Ganoderma lucidum* (c) and *Ganoderma resinaceum* (d).

Material and Methods

Antifungal/antagonistic activity (AFA/AA) of 22 collections of 4 *Ganoderma* species (*G. adspersum, G. applanatum, G. lucidum, G. resinaceum*) with different geographical origin (Armenia, China, France, Iran, Italy) were studied against 9 species of phytopathogenic fungi (*Bipolaris sorokiniana, Fusarium culmorum, Fusarium oxysporum, Pestalotiopsis funerea, Rhizoctonia cerealis*) and their antagonists (*Trichoderma asperellum, T. harzianum, T. pseudokoningii, T. viride)* in dual cultures experiment (**Fig. 1, 2**) [4,5].
Several types of antagonistic reactions, such as deadlock at a contact (type A) and at a distance (type B), overgrowth (type C), partial (type C_{A1}) and complete (type C_{A2}) replacement after initial deadlock were described between contacted colonies (**Fig. 3**).

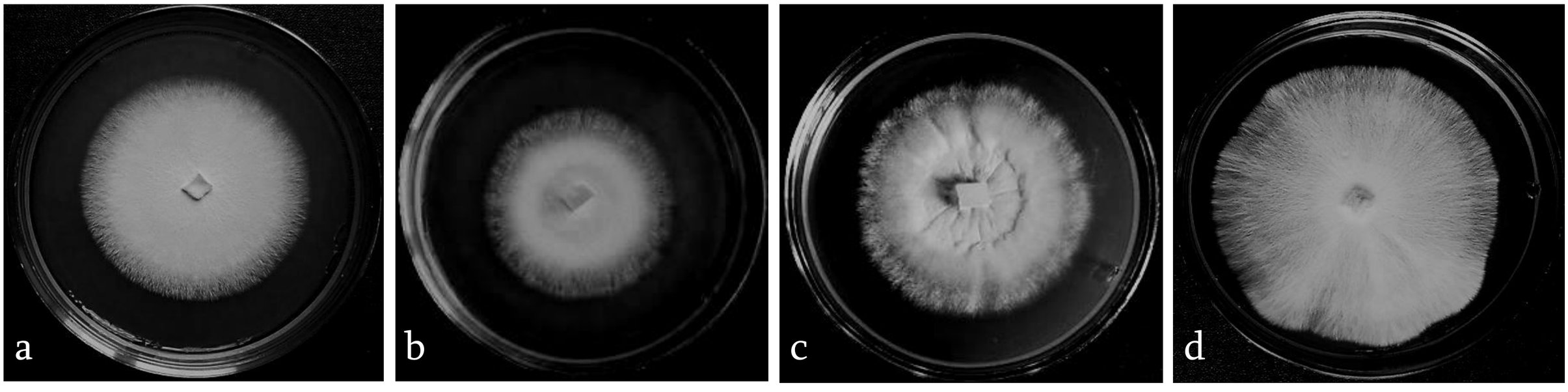

Fig. 2. Colony morphology of *Ganoderma adspersum* (a), *G. applanatum* (b), *G. lucidum* (c), and *G. resinaceum* (d) on MEA, 6th day of growth, at 25^{o} C.

Results and Discussion

All *Ganoderma* collections, particularly *G. resinaceum, G. adspersum* and *G. applanatum* possess significant antifungal/antagonistic activity (AFA/AA) against test phytopathogenic fungi. High antagonistic activity against *Ganoderma* species, except *G. resinaceum* was detected by phytopathogen *F. culmorum* and *Trichoderma* species.

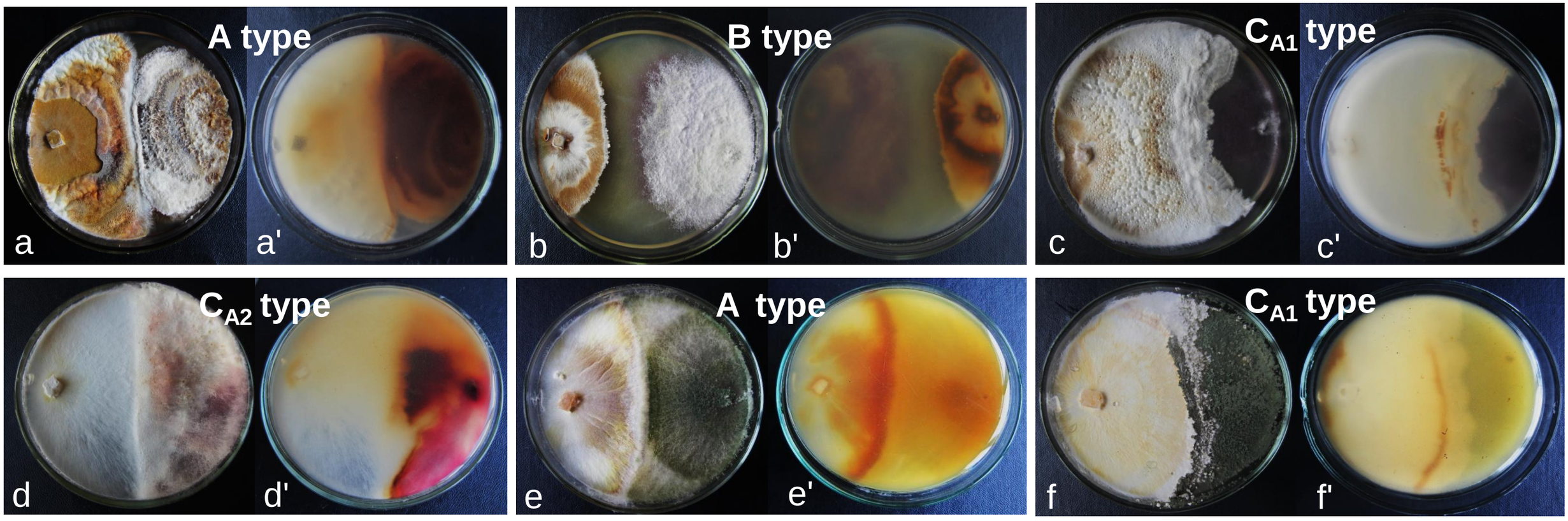

Fig. 3. Interaction between *Ganoderma* collections, phytopatogenes and their antagonists: *G. lucidum* and *P. funerea* (a,a') and *F. oxysporum* (b,b'), *G. adspersum* and *F. oxysporum* (c,c'), *G. resinaceum* and *F. culmorum* (d,d') *G. resinaceum* with *T. harzianum* (e,e') and *T. pseudokoningii* (f,f').

No significant difference in average growth rate indicators (GR_{avr}) of mycelia of *Ganoderma* mushrooms and test-filamentous fungi compared with control data was revealed (**Table 1**). In *G. adspersum*, *G. lucidum* and *G. resinaceum* stimulation of growth rate, particularly by *Fusarium* species was detected.

Table 1. Average growth rate (mm/d) indicators of fungal collections in dual culture experiment

Tested microfungi	***Ganoderma* collection**								**Control (M)**
	G. adspersum		***G. applanatum***		***G. lucidum***		***G. resinaceum***		
	G	**M**	**G**	**M**	**G**	**M**	**G**	**M**	
B. sorokiniana	7.1	6.8	4.9	6.6	5.2	6.0	11.2	8.0	**11.0**
P. funerea	7.8	8.1	4.3	7.3	7.2	8.0	16.7	8.7	**8.0**
F. culmorum	9.1	15.3	5.7	15.3	8.5	14.7	16.0	16.0	**14.0**
F. oxysporum	9.1	15.3	5.7	15.3	8.5	14.7	16.0	16.0	**14.0**
R. cerealis	6.9	4.0	5.0	3.4	6.8	2.8	8.2	2.8	**2.8**
T. harzianum	4.2	9.3	4.2	12.3	5.1	10.7	6.0	8.9	**9.5**
T. pseudokoningii	4.5	14.7	3.8	17.3	5.1	17.8	6.5	14.5	**16.0**
T. asperellum	4.2	12.0	3.2	12.7	4.7	12.4	6.7	12.4	**13.5**
T. viride	4.5	13.0	3.8	13.2	4.5	13.2	6.7	13.2	**14.0**
Control (G)	**6.0**		**5.0**		**5.2**		**7.2**		

Notes: (G) - *Ganoderma* species, (**M)** - test-microfungi.

Table 2. Frequency of occurrence of interaction types between *Ganoderma* species and test-microfungi in dual culture

Type of interaction	Phytopathogen	Antagonist
Mutual deadlock		
A	27.27	5.68
B	2.73	0
Total	**30.00**	**5.68**
Overgrowth by *Ganoderma* species		
C_{A1}	47.27	4.55
C_{A2}	14.54	0
Total	**61.81**	**4.55**
Overgrowth by test microfungi		
C	0	5.68
C_{A1}	7.27	7.95
C_{A2}	0.90	76.14
Total	**8.17**	**89.77**

Conclusion

Tested *Ganoderma* collections are potential producers of antifungal metabolites which significantly suppressed the growth of test phytopathogenic fungi. Among tested *Ganoderma* species the highest activity was detected in *G. resinaceum.*

Further studies will assist to develop novel bio-control agents from wood inhabiting *Ganoderma* mushrooms against certain plant pathogenic fungi.

References

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