ANTAGONISTIC INTERACTIONS OF *GANODERMA LUCIDUM* (LEYSS.) KARST. AGAINST SOME SOIL MICRO-ORGANISMS

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GANODERMA LUCIDUM (Leyss.) Karst is a destructive root pathogen of sissoo, khair, *Acacia auriculiformis*, *A. nilotica*, *Cocos nucifera*, *Jacaranda acutifolia*, *Cassia fistula*, *Delonix regia* and many other hardwood species used for forest plantations and trees for avenues[1,2]. The sand-dune plantations of *Acacia tortilis* in Haryana and the coconut plantations in southern states have also been severely attacked by the fungus. Soil-borne and other mycoparasitic fungi offer new opportunities for biological control of the pathogen[3–5]. In the present study an effort was made to control this fungus by studying its colony and hyphal interactions against some common soil fungi and bacteria.

The fungal species selected for studying the colony interaction against *G. lucidum* were *Aspergillus niger* van Tieghem, *A. terreus* Thom, *A. fumigatus* Fresenius, *Alternaria humicola* Oudemans, *Curvularia lunata* (Walker) Boedijn, *Penicillium roseopurpureum* Dierckx, *P. canescens* Sopp, *Fusarium oxysporum* Schl., *Myrothecium roridum* Tode, *Rhizopus stolonifer* (Ehranb. ex. Fr.) Lind, *Trichoderma koningii*, Oudemans, septate sterile mycellium (SSM) and *Bacillus subtilis*. All the micro-organisms were grown on 2% malt extract agar (MEA). The colony interaction between *G. lucidum* and other test fungi was studied by taking 5 mm discs of test fungus cut from the actively growing margin of a young colony and placing it on a sterile MEA plate. The other fungi were also placed at a distance of 3.5 cm apart from the test fungus in the same petri dish. Three replicates were prepared for each micro-organism. The plates were incubated for 6 days in dark at 25 ± 2°C and their growth pattern vis-a-vis *G. lucidum* was studied.

Skidmore and Dickinson[6] described five types of colony interactions, i.e. (i) mutual intermingling growth of interacting fungi, (ii) overgrowth by antagonist, (iii) overgrowth by test fungi, (iv) slight growth inhibition of interacting colonies c. 2 mm, and (v) mutual interaction of both the colonies at a distance > 2 mm. Thus the fungi belonging to groups C and D were identified as *T. koningii*, *A. terreus*, *M. roridum*, SSM and *B. subtilis* and taken for further studies on hyphal interaction.

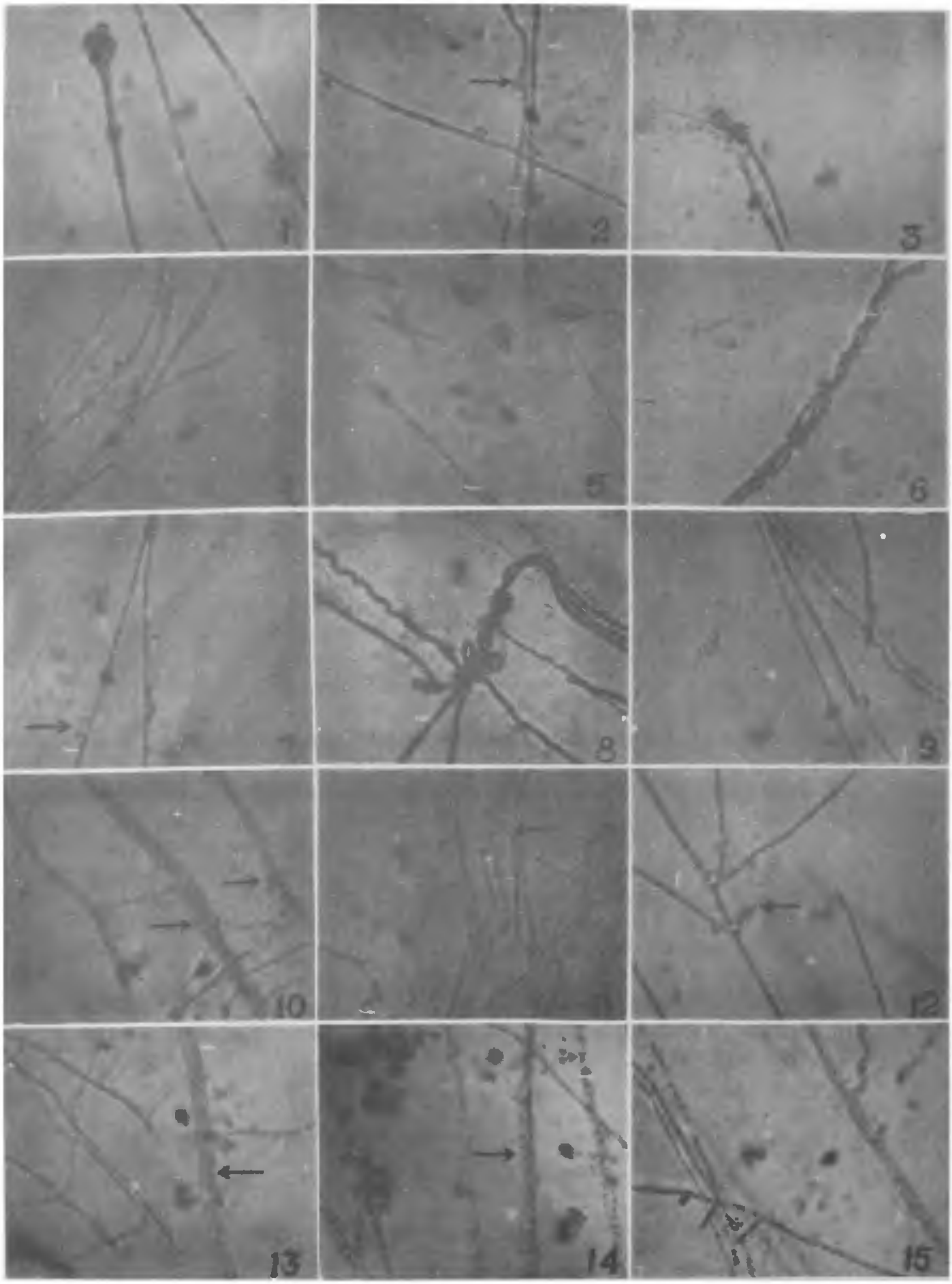
A thin layer of MEA medium (3 cm length) was spread over the surface of sterilized slide and a small block of *G. lucidum* (3 mm^3) cut from the actively growing margin was placed over it. Similarly other micro-organisms were also placed individually at a distance of 1 cm. The entire contents were covered using a 5 cm cover slip and placed in a damp chamber at 25 ± 2°C. Observations were taken at intervals of 8 h and when the hyphal tips begin to come close, these were studied directly under the stereo binocular microscope.

B. subtilis induced coiling at the hyphal tips, disintegration of clamp connections, bursting of hyphae, chlamydospore formation and general coiling (figures 1–6). In the case of *M. roridum* coiling, deformation and degeneration of clamps into branches were observed (figures 7–9). Pairing and emptyness of protoplasmic contents from the test fungus were noticed in SSM (figures 10, 11) whereas the hyphae of *A. terreus* penetrated (figure 13) into the hyphae of *G. lucidum* and induced disintegration of clamps (figure 12). The antagonistic effects of *T. koningii* prevailed upon the test fungus by way of causing penetration (figure 14) and vacuolation (figure 15).

An attempt was made to quantify the interactions obtained during the experiment by employing the

Table 1 *Per cent interaction of the hyphae of G. lucidum against soil micro-organisms*

Name of fungi/bacteria	Colony interaction type and their score	% hyphal interaction
Bacillus subtilis	D-5	44
Myrothecium roridum	C-4	32.9
Septate sterile mycelium	C-4	58.8
Aspergillus terreus	C-4	55.2
Trichoderma koningii	D-5	60.2



Figures 1–15. (×400). **1–6.** Hyphal interactions of *G. lucidum* with *B. subtilis*; **7–9.** *M. roridum*; **10, 11.** Septate sterile mycelium; **12, 13.** *A. terreus*; **14, 15.** *T. koningii*.

following formula:

$$\text{Per cent interaction} = \frac{\text{Number of interacting hyphae in one microscopic field}}{\text{Total number of hyphae in a microscopic field}} \times 100,$$

where the interaction collectively represents coiling, penetration, vocuolation and deformation of clamp connection. The results presented in table 1 indicate that all the fungi taken showed interaction > 30% and were potential antagonists. The maximum interaction percentage was found in the case of *T. koningii* followed by SSM, *A. terreus, B. subtilis* and *M. roridum.* In the field trials the choice of *B. subtilis* has to be restricted because of its inducing the formation of chlamydospores. *M. roridum* and *A. terreus* hampered the formation of clamp connection, thus destroying the useful chain in the life history of the pathogen. *T. koningii* may also be considered for further trials as it was useful in inducing vacuolation followed by autolysis and death of the fungus.

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REPORT OF *BLEPHARIPA ZEBINA* WALKER (TACHINIDAE) AS A SERIOUS PEST OF MUGA SILKWORM, *ANTHERAEA ASSAMA* WESTWOOD (SATURNIIDAE)

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UZIFLY is a threat to the sericulture industry especially in the tropical belt. On a global basis, over 20% of the annual damage to sericultural crop is attributed to this pest[1]. *Tricholyga bombycis* Beck (Tachinidae) has been reported as a serious pest of mulberry silkworm, *Bombyx mori* L[2–4]. The same species is recorded as a pest of the domesticated eri silkworm, *Philosamia ricini*[5] and a semi-domesticated muga silkworm, *Antheraea assama* Ww[1,6,7].

A high rate of uzi infestation in recent years in North Eastern India has adversely affected the progress of muga culture resulting in considerable reduction in cocoon production. Studies on the seasonal incidence revealed that the infestation varied from 6.40 to 69.62% during different seasons. Peak incidence of infestation was recorded during winter (51.87–69.62%) followed by early spring (50.85%) and a lower incidence during autumn (6.40–9.09%). The present authors noticed two types of uziflies based on morphological characteristics. One species was found to be larger in size than the other, prevailed throughout the year and caused 80% of the total damage. This species was identified as *Blepharipa zebina* Walker by the CAB Institute of Entomology, London. *B. zebina* Walker is reported to be a dreadful pest of tasar silkworm, *Antheraea mylitta* Drury[8]. However, this is the first report of *Blepharipa zebina* Walker (Tachinidae) as a serious pest of muga silkworm. *Antheraea assama* Ww. hitherto not reported. Detailed work on the morphology and biology of both species and identification of the second species are under progress.

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*Deceased.