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SYNERGISTIC EFFECTS BETWEEN WILD MUSHROOM EXTRACTS AND STANDARD ANTIBIOTICS AGAINST MULTI-RESISTANT BACTERIA

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The indiscriminate use of antibiotics and chemotherapeutic agents, among other factors, has been contributing for the development of resistant species (Andrade et al. 2006). Bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and Extended-spectrum β -lactamase (ESBL)-producing *Escherichia coli* are microorganisms of concern with regard to multi-resistances. Due to this problem, there is a need to investigate new strategies to reverse this tendency in order to achieve the appropriate and effective treatment against infections by such microorganisms. Natural matrices, in particular wild mushroom extracts emerge as interesting possibilities to be explored as antimicrobial drugs (Alves et al. 2012a).

Our previous results proved the antibacterial activity of extracts from specific wild mushrooms (*Fistulina hepatica*, *Leucopaxillus giganteus*, *Mycena rosea*, *Russula delica*, *Sarcodon imbricatum*) (Alves et al. 2012b). Those extracts were applied upon different multi-resistant microorganisms (*Escherichia coli*, Extended-spectrum beta-lactamase-producing (ESBL) *Escherichia coli* and Methicillin-resistant *Staphylococcus aureus* (MRSA), combined with commercial antibiotics (penicillin, ampicillin, amoxicillin/clavulanic acid, cefoxitin, ciprofloxacin, cotrimoxazol, levofloxacin). The main objective was to evaluate the capacity of natural extracts to potentiate the action of standard antibiotics, through synergisms that allow a decrease in their therapeutic doses and ultimately contribute to the reduction of resistances. Microdilution method was used to determine minimum inhibitory concentrations (MICs).

The results obtained showed higher synergistic effects against MRSA than against *E. coli*. *Mycena rosea* and *Fistulina hepatica* were the best mushroom extracts for synergistic effects against MRSA. The efficiency of *Russula delica* extract against *E. coli* 1 (resistant to ampicillin, ciprofloxacin and trimethoprim/sulfasoxazole) and *E. coli* 2 (resistant to amoxicillin/clavulanic acid and ampicillin) was higher than that of *Leucopaxillus giganteus* extract; nevertheless the latter extract exhibited better synergistic effects against ESBL *E. coli*.

This study shows that, similarly to plants, some mushroom extracts can potentiate the action of antibiotics extensively used in clinical practice for Gram-positive or Gram-negative bacteria, with positive action even against multi-resistant bacteria. Therefore, mushroom extracts could decrease therapeutic doses of standard antibiotics and reduce microorganism's resistance to those drugs.

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