SECTION V
GENERAL SUMMARY
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On account of their great potentiality for the production of natural indigenous drugs, including various antimicrobial substances, and because of the lack of any previous work on medicinal plants of this region, the present attempt was made to study the plants used by the local inhabitants of Bundelkhand (Central India) for the treatment of common ailments, including various infectious diseases. With a view to further evaluating some of these ethnobotanical observations, the antimicrobial activities of certain common plants against various human pathogenic fungi and bacteria were also investigated.

The ethnobotanical investigations were carried out in selected localities of Banda, Hamirpur, Jhansi, Lalitpur and Sagar districts. These areas are particularly rich in tribal and rural population as well as in wild plants.

The data about the traditional use of medicinal plants for the treatment of various infectious and other important diseases were recorded by interviewing various tribals and other local inhabitants. A total of about 230 ethnomedicinal uses, prescriptions of about 191 species of plants, were recorded and incorporated. Of these, about 32 species of plants have been found by a number of workers
to be used for almost similar purposes in different parts of India. These plants could, therefore, be considered important ethnomedicinal plants. About 93 plants, however, appeared to be used only by the natives of Bundelkhand region; their use in other parts of the country could not be confirmed from the available ethnobotanical records.

According to common folklore claims, several plants appear to be of considerable medicinal importance as they are often used for the treatment of various common ailments. These included *Aegle marmelos* (diarrhoea and dysentery), *Argemone mexicana* (conjunctivitis), *Cassia fistula* (stomach-ache), *Centella asiatica* (dysentery and skin infections), *Helicteres isora* (stomach disorder), *Mucoza prurita* (impotence), *Oxalis corniculata* (dysentery), *Plumbago zeylanica* (fever), *Pongamia pinnata* (rheumatic joint pain and skin diseases), *Sida cordifolia* (spermatorrhoea) and *Vitis quadrangularis* (bone fracture).

Obviously, on account of lack of proper sanitary facilities and unhygienic living conditions, skin diseases were found to be more prevalent in various localities of this backward region. Consequently, the majority of plants mentioned were those used by the local inhabitants for the treatment of skin infections. Some tribals and holy men were found treating even leprosy and leucoderma by using
certain important local medicinal herbs, vis., Alestra parasitica var. chitrakutensis, Plumbago seylanica, Psoralea corylifolia, and Eclipta alba.

Interestingly, A. parasitica var. chitrakutensis happened to be the most important indigenous antileprotic drug, though, surprisingly, it has not been mentioned in any of the standard classic publications on Indian medicinal plants. This may probably be due to its restricted distribution as the plant was reported only from the Chitrakut area (Banda district U.P.). During the course of the present investigation, however, this plant has been collected for the first time from certain other areas of Bundelkhand region also, including various nearby localities of Banda (Banda district) and Syondhi forests (Hamirpur district, U.P.).

Thus the present ethnobotanical observations offer a good scope for further detailed scientific investigations on some of these medicinal plants of this region.

Due to the increasing importance of higher plants in the search for natural and new antimicrobial agents, the medicinal plants, particularly those which are commonly used for the treatment of infectious microbial and other common diseases, by the local inhabitants of the area under study, were selected and screened for their antimicrobial activity. The expressions of 73 fresh plants, ethanol extracts of
51 plant samples and seed-extracts of 14 plant samples were tested for their antimicrobial activity against three well-known human pathogenic fungi, viz., *Aspergillus fumigatus*, *Trichophyton mentagrophytes* and *Candida albicans* and three bacteria including *Escherichia coli*, *Bacillus subtilis* and *Streptococcus faecalis*.

In general, the antimicrobial property of plants was found to differ greatly in its distribution from species to species. The majority of the plant extracts showed antibacterial activity whereas only a few exhibited fungitoxic property. Comparatively, fresh plant expressions were found to be more antifungal than the extracts of air-dried plant materials. Besides, more plants showed antibacterial activity against Gram-positive bacteria as compared to Gram-negative bacteria. The occurrence of highly active antifungal and/or antibacterial agents, however, was very rare.

Out of the total 138 plant samples screened, 65 plants were found to be active against one test microorganism or the other. Interestingly, the antifungal and/or antibacterial property in almost all these plants showed a good deal of correlation with their respective ethnobotanical uses.

A number of plants, including mainly *Psoralea corylifolia*, *Ranunculus sceberatus*, and *Trachyspermum ammi*, exhibited
remarkable 'in vitro' antifungal and antibacterial activity. Thus these plants appeared to possess a good deal of antiseptic property. *Agave americana* and *Allium sativum* showed high antifungal activity against one or the other test fungi while *Alectra parasitica* var. *chitrakutensis*, and *Trigonella foenum-graecum*, proved very efficacious, especially against Gram-positive test bacteria.

Due to their great ethnomedicinal importance, high antibacterial and/or antifungal activity, (and the existing meagre botanical and phytochemical knowledge of them), *Alectra parasitica* var. *chitrakutensis* and *Agave americana*, were selected for further study on preliminary phytochemical analysis and antimicrobial screening of different fractionates and their important phytochemical constituents.

With a view to extracting out the antimicrobial substances, the usual organic solvents including petroleum ether, benzene, solvent ether, chloroform, acetone, ethanol and chloroform-water (1:9) were used for the purpose of successive extraction of the plant material. The extracted samples were then tested for their antibiotic activity against 5 test fungi, viz., *Aspergillus fumigatus*, *A. flavus*, *A. candidus*, *Trichophyton mentagrophytes* and *Candida albicans* and 5 test bacteria including *Escherichia coli*, *Bacillus subtilis*, *B. anthracis*, *Streptococcus faecalis* and *Staphylococcus albus*. 
In the case of *A. parasitica* var. *chitrakutensis*, the results of phytochemical analysis revealed the presence of sterol(s), alkaloid(s), glycoside(s), flavonoid(s), carbohydrates and tannin(s), while *A. americana* contained only sterol(s), carbohydrates, alkaloid(s), and saponin(s).

On the basis of the comparison of the results of phytochemical analysis with the antimicrobial activity of different fractionates, the sterols present in solvent ether fraction and any one or the mixture of more than one of the glycosides, carbohydrates, alkaloids, flavonoids and tannins in ethanol fraction could be responsible for the antibacterial activity of *A. parasitica* var. *chitrakutensis*.

In the case of *A. americana*, pronounced antifungal activity was however, recorded in ethanol and chloroform-water (1:9) fractions, which on phytochemical analysis showed the presence of carbohydrates, alkaloids and saponins.

All the phytochemical constituents of both the plants which seemed to be responsible for antimicrobial activity, were also extracted out separately by suitable standard chemical methods. Each sample was then again verified for the presence of the respective constituent and its antibiotic activity. On the basis of the overall experimental results of these investigations, the antibacterial activity
of *A. parasitica* var. *chitrakutensis* could be attributed to sterols and flavonoid-glycosides. However, steroidal saponins were found to be the active antifungal substances in *A. americana*.

As such, on the whole, some of these medicinal plants of Bundelkhand region, especially *Alectra parasitica* var. *chitrakutensis* and *Agave americana*, appeared to be of great fundamental and applied importance.