

Ethnobotanical Uses of Plants by the Tribals of Rajasthan

Sanjay Kumar Acharya

Professor, Dept. of Botany, Govt. Dungar College, Bikaner, Rajasthan, India

ABSTRACT: The term “Ethnobotany” was coined by J. W. Harshberger in 1895 to indicate plants used by the aboriginals: From “ethno”-study of people and “botany”- study of plants. Ethnobotany is considered as a branch of ethnobiology. It deals with the study and evaluation of plant-human relations in all phases and the effect of plant environment on human society. Rajasthan has rich biodiversity consisting of a large number of plants, some of which are used for their medicinal value. The herbal medicines used in Rajasthan (India) are shown in Figure 1. Rajasthan is one of the largest states of India. About 12.44% of the population belongs to tribes such as the Bhil, Bhil-Meena, Damor, Dhanka, Garasia, Kathodi, Kokna, Kolidhor, Naikara, Patelia, Meena, and Seharla and reside in remote areas devoid of basic infra-structure facilities. Nomadic tribes (Banjara, Gadolia-Lohar, Kalbelia, Sikligar, Kanjar, Sansi, and Bagri) further enrich the ethnic heritage of Rajasthan. These ethnic groups are widely distributed throughout the state and have considerable communication with each other. As a result, most of the ethnobotanical information is passed by one group to the other. Although, flora of Rajasthan has been compiled by Bhandari (1990) and Sharma (1993) but detailed information about their medicinal properties are lacking. The present review highlights the importance of ethno medicinal plants from different regions of Rajasthan.

KEYWORDS-ethnobotany, plants, uses, tribals, Rajasthan

I.INTRODUCTION

The state of Rajasthan has a sizable tribal population existing in the still surviving deciduous forests of the Aravalli and Vindhyan ranges. Though having undergone varying degrees of change, a substantial population even today can be seen thriving in primitive conditions with preserved traditions. Of such groups, the Bhillas are the largest, followed by Garasias and Damors. The Kathodias and Sahariyas are still sociologically not very well known. Living close to nature, the tribals have acquired unique knowledge about the properties and uses of wild plants, most of which are not known to the outside world. Until a decade ago, nothing was known about the ethnobotany of the tribes of Rajasthan. Exhaustive field work in tribal villages with a macro-level perspective brought forth interesting revelations from the panorama of their lives. A total of 147 species belonging to 62 vascular plant families are reported. From these 145 species were reported to be used for medicinal applications, 135 species of which were used to treat more than one disease and remaining 8 species were used to treat only one disease. [1,2,3] The most widely used plant part is leaves (95 species) and the most common mode of application is oral (39.65%). The traditional knowledge about the plants can be used to produce new products for medicinal use, food and fodder. Rajasthan has rich cultural diversity and biodiversity. Ethnobotany can be defined as the total natural and traditional relationship and the interactions between man and his surrounding plant wealth from times immemorial, due to sheer necessity, intuition, observation and experimentation. Medicinal plants are valuable and are used for the production of various drugs. These plants produce a high diversity of natural products or secondary metabolites like Mahanimbicine, Andrographine, murrayaline, lupeol and limonin, etc., with a prominent function in the protection against diseases like diabetes, kidney stones, osteoporosis, tumors, ophthalmia, leucorrhoea, bronchial asthma, diarrhea, cancer, etc. [7,8] Medicinal plants are the potent source of life saving drugs for the majority of world's population. It is estimated that 70-80% of people world-wide rely mainly on traditional, largely herbal medicines to meet their primary health care needs and have gained renewed interest for various reasons, affordability, low pricing, little or no side effects, their solutions for chronic diseases and disorders, time tested remedies and several preventive approaches. Over the years herbal medicines have gained upward trend for consumption especially with the development and standardization of herbal medicines. Plant based drugs have a long history in both traditional and modern societies as herbal remedies or crude drugs, or as purified compounds approved by the Food and Drug Administration and similar regulatory agencies. According to one estimate 20,000 to 35,000 species of plants are used as medicines, pharmaceuticals, cosmetics and nutraceuticals by different ethnic groups the world over. [4,5,6] In most of these species active principles are exploited in modern medicines and referred to as plants of scientific knowledge. Drug discovery from plants still provides important novel drugs, many of which are approved or have undergone trials for clinical uses against cancer, malaria, Alzheimer's disease, HIV/AIDS, pulmonary pathologies and other deadly diseases. Enhanced market demands have posed threats to phyto resources due to unscrupulous mode of collections. There is an urgent need to conserve genetic diversity of medicinal plant resources by



developing protocols for micropropagation. Plant, cell, tissue, organ culture techniques offer an integrated approach for rapid multiplication and production of material with dependable active ingredients. The conventional cultivation of some of the medicinal plants is relatively expensive and production of medicinal compounds can be elicited in vitro. Due to extensive utilization of medicinal plants for medicine and scientific research, many of them are facing extinction; therefore it is imperative to adopt alternative methods for rapid multiplication of such plants

II.DISCUSSION

The tribal population in India is quite considerable, i. e. 53 million, forming 8% of country's total population. Over 550 ethnic groups are found in different geographical habitats. (Anonymous, 1994). Rajasthan has about 70.97 lac tribal population (fifth rank in India) forming 12.5% of state's total population. Twelve tribes occur in Rajasthan, of which five are demographically important viz. Bhil, Damor, Garasia, Meena and Saharia. The Dang region comprising of Karauli, Sawai Madhopur, and Dholpur districts is rich in forests as well as in tribal and traditional communities. The main tribe of Dang is Meena, while traditional communities are Gurjar, Mali, Chamar, Jogi etc. Meena represents about 50% population of tribals in the state. Plants are the bases of tribal lives from birth to death. This inter relationship has evolved over generations of experiences and practices. The general climatic condition of the region is dry, except a short duration of rainy season. December to February is cold season, March to June summer, July to September rainy season and October to November is autumn season. The average annual rainfall of the study areas is 689 mm. The average maximum and minimum temperatures remain 41° and 25°C respectively during summer. Relative humidity is generally over 60% during the rainy season. The rivers Chambal, Banas, Morel and Gambhir with their tributaries pass through the area. The forest falls under Tropical Dry Deciduous Forests. The forests cover varies greatly in composition and quality. *Anogeissus pendula* is the predominant species distributed almost throughout the area, forms almost pure stands at certain places. Tribal and traditional communities are using 36 plant species as cooling agents during summers. The various mode of administration are as follows: 1. Plant part made edible either by powdering and mixing with other ingredients as food. 2. Raw plants/parts/products. 3. Extract by crushing or pounding fresh drug or slicing it. 4. Juice/ simple rubbing of plant part. 5. Cooking as vegetables, laddoes, halwa etc. 6. Paste. 7. Oils. Most plants used by tribal and traditional communities are easily available near hut or in village. It is easy to fetch them. Generally plants are used in a crushed form. This study established that many different parts of the plant species are used as medicine e.g. root, stem, leaf, seeds, flowers, gum, whole plant etc. [10,11,12] The most commonly used plant part is leaf and seeds. Amongst 36 plant species leaves of 10 species, whole plant and seeds of 7 species, roots of 5 species are used to calm body heat. Gum of 3 species eaten raw or with water. Root juice of 3 species, fruit powder or pulps of 4 species are used as cooling agents. Tuber of 1 species eaten and oil applied to cure heatstroke

Enumeration Plants are described alphabetically with their local name followed by family and their mode of use: *Acacia nilotica* (L.) Bamool, Bamoor Gum eaten raw. Leaf paste mixed in curd is taken. Root juice is mixed with sugar candy, cardamom, vanshlochan and roots of *Chlorophytum* and taken by females. *Achyranthes aspera* L. Onga, Chirchita The paste or powder of seeds is taken orally. *Aegle marmelos* (L.) Corr. Bel Fruit pulp or powder is eaten directly or mixed in curd or water and taken. *Amorphophallus commutatus* Engler, Sukerkand Tuber is eaten raw. *Benincasa hispida* (Thumb.) Cong. Petha A cut is made into fruit and filled with wheat (grains), after 2-3 days fruit is cut into pieces and dried with grains. These dried pieces and grains ground and roasted in ghee, mixed with sugar, made into laddoes and eaten in summers. It is very effective against body heat and prevents heatstroke. *Boerhavia diffusa* L. Santhi Root pounded with seeds of black pepper and candy, is taken orally during summers. *Bombax ceiba* L Semra Root pounded with of *Chlorophytum tuberosum*, *Capparis sepiaria* and fruits of *Pedaliium murex* are taken with water as tonic. *Butea monosperma* (Lam.) Taub. Chhola, Chheela Gum locally called 'Kamarkas ka gond' is powdered or boiled and taken with milk in the morning. Extract of roots is mixed with ghee and roasted along with wheat flour, made into laddoes and eaten in summers to prevent heatstroke. *Capparis sepiaria* L. Heens, Jaal Root is powdered with that of roots of *Chlorophytum tuberosum*, *Bombax ceiba* and fruits of *Pedaliium murex* and taken with water. *Chlorophytum tuberosum* (Roxb.) Baker Safed moosali Roots crushed into paste, mixed in water, filtered and taken with candy. Roots powdered with that of *Capparis sepiaria*, *Bombax ceiba* and fruits of *Pedaliium murex* and taken with water. *Cocculus hirsutus* (L.) Diels. Jaljamni Extract of fresh leaves is mixed with water and candy and this jelly is taken in summers. *Corchorus depressus* (L.) Stocks Ondhphari Plant dried in shade, is powdered and taken with candy and whey. *Coriandrum sativum* L. Dhana Seeds powder mixed with sugar and eaten. *Crotalaria medicaginea* Lam. Jhojhru Leaves and seeds are crushed, mixed with sugarcandy and taken orally. *Dactyloctenium aegypticum* (L.) Willd. Makra ghas Seeds are pounded and used to prepare halwa and eaten as cooling agent. [13,14,15] *Echinops echinatus* Roxb. Oont katela Plant paste smeared on soles and palms to treat heatstroke. *Euphorbia granulata* Forsk. Chhoti dudhi Paste of whole plant is mixed with curd and taken orally. *Ficus benghalensis* L. Bad, Bar Rice is boiled in the decoction of root, mixed with cow's ghee and eaten to cool down body heat. *Ficus racemosa* L. Gular Fruit paste mixed in water is taken as refrigerant. About 15-20 fruits soaked in water for 4-5 hours are stirred properly, filtered and sugarcandy is added, stored in an earthen pot, kept on the roof for overnight and eaten in the morning. *Grewia tenax*



(forsk.) fiori Chabeni Leaves are pounded with black pepper and candy and taken orally. *Heliotropium europaeum* L. Oont kameda Plant extract or leaf paste is applied locally on palms, soles or body or mixed with extract of bulb of *Allium cepa* and used to massage soles and palms 2-3 times a day to treat heatstroke. *Lawsonia inermis* L. Mehendi Leaf paste is applied on soles and palms. *Mangifera indica* L. Aam Raw fruits are roasted in warm ash or boiled, pulp is mixed with water, salt, sugar and cumin seed powder to make a drink and taken as cooling agents. *Mentha spicata* L. Podina Decoction of plant is mixed with black pepper powder and salt and taken orally. *Mucuna pruriens* (L.) DC. Koanch Seeds powder is taken with water. *Ocimum canum* Sims. Nagad bavri Seeds are boiled in milk with sugar and eaten or made into solid laddoes and eaten. Seeds are soaked in water during night and taken next morning. *Petalium murex* L. Dakhini gokharu Plant is dipped in water 7-10 times and this water is taken orally. Extract of plant is taken orally or powder is roasted in ghee, used to make laddoes and eaten. Crushed plant is soaked in water, filtered in next morning, filtrate mixed with sugrcandy and black pepper powder and taken. *Phyllanthus fraternus* Webster Bhui amla Crushed plant mixed with black pepper powder, candy and water and taken. *Saccharum bengalense* Retz. Moonj Leaves are soaked in water and this water is used to message the body against heatstroke. *Sesamum indicum* L. Oil mixed with cow ghee and is applied on scalp as refrigerant to cure sunstroke. [16,17,18] *Sida cordifolia* L. Kharenta Root paste is mixed in water and taken as refrigerant. Seeds powder is roasted with wheat flour in ghee and mixed with sugar and made into laddoes, which are eaten in summers. *Sterculia urens* Roxb. Karah Gum is soaked in water and eaten. *Tribulus terrestris* Tourn. ex L. Gokhru Seeds are used to prepare laddoes and eat *Tridax proumbens* L. Khoon datani, Kalo bhamro Leaf juice or paste mixed in whey or curd is taken orally. Plant juice mixed with candy and milk and taken for 10-15 days. *Vernonia cinerea* (L.) Less. Sehdei, Khukhreda Plant juice is mixed with paper powder and candy and taken. *Xanthium strumarium* L. Adhasisi Leaf powder is taken with water.

III. RESULTS

Tribal and rural people of Mount Abu region in Sirohi District use these plants in their day to day life for treatment of various ailment viz. asthma, malaria, heart disease, labour pain, sexual weakness, liver disorder, anemia, bronchitis, sore joints, abdominal pain, ulcers, dysentery, vomiting, vermifuge, nausea, night blindness etc. Further pharmacological investigations on these plants will benefit mankind. Such ethnomedicinal studies may also help in conserving the biodiversity. The results show that gender and age class differ in their traditional knowledge with regard to medicinal plants reported. Males above 50 year of age had more traditional knowledge about medicinal plants and their uses than females. This may be attributed to their involvement in trade related activities. In most of the cases the older people were noted as being better informants and the vivid reason for this may be their personal experience of using these plants since old times. We learned through the survey that local people are still dependent on plant resources for treatment of various ailments, but this kind of dependence is decreasing. This is likely due to multiple reasons. One such reason is lack of belief of the young generation in the traditional medicine systems and increasing use of allopathic medicines due to their availability and efficacy. Another reason likely is the harvest by drug manufacturers especially in areas near settlements and pastures, leaving behind very little for access by local communities. Mostly the tuberous plants grow in shady and moist places but due to habitat destruction, climatic changes, introduction of exotic species (*Lantana amara*, *Parthenium* etc), overexploitation for food and medicine; the natural wild tuberous plants are facing the threat of extinction e.g. *Ceropegia odorata* which was endemic in eastern Rajasthan (Mt.Abu) but now it has not been reported in last decades that means it has been extinct now. Most tuberous plants have been categorized into rare and endangered. This lack of effort to sustain resources may result in their depletion from natural habitats. There is a great need to create awareness among the indigenous communities about endangering medicinal plants, if over exploited to meet market demand. *Arisaema tortuosum*, *Costus speciosus*, *Eulophia ochreatea*, *Leea indica*, *Leea macrophylla*, *Pureria tuberosa*, *Corallocarpus epigaeus* etc. have medicinal value belonging to rare category while *Ceropegia bulbosa*, *Ceropegia tuberosa* and *Pureria tuberosa* having food value, but due to overexploitation now they have become rare and endangered and there is great threat of extinction. Genus *Dioscorea* which was much abundant previously has been kept into rare category. Many plants are cultivated by tribals abundantly and sold in nearby market. These plants have much nutritional value. *Ceropegia bulbosa*, *Ceropegia tuberosa*, *Colocasia esculenta*, *Curcuma amada*, *Dioscorea bulbifera*, *Dioscorea hispida*, *Dioscorea tomentosa*, *Daucus carota*, *Iphigenia indica*, *Nelumbo nucifera*, *Pupalia atropurpuria*, *Pureria tuberosa*, *Raphanus sativaus*, *Zingiber officinale* are wild tuberous plants which are used by tribals as food. If proper strategies are proposed then these plants may become the part of tribal economy. Some tuberous plants e.g. *Curcuma amada* and *Zingiber officinale* are widely used as spice and condiment not only by the tribals but also by the urban peoples. Along with food value some plants e.g. *Crinum asiaticum* and *Gloriosa superba* now have become beautiful ornamental plants but both are rare plant and found only in protected forest. Some plants are poisonous too e.g. *Gloriosa superba*, *Crinum asiaticum*, *Urginea indica*, *Withania somnifera*, (Seed), *Dioscorea bulbifera*. It is reported that being poisonous they have great medicinal value too. The tribal people have much knowledge about the detoxification; they use *Dioscorea bulbifera*, *Urginea indica* after detoxification, they either keep them overnight in running water or boil with water and after that they cook them. Nearly about all plants are reported to be medicinal having medicinal value of curing various ailments. *Arisaema*



tortuosum, *Curculigo orchiooides*, *Ceropegia tuberoae*, *Curcuma amada*, *Cayratia trifolia* *Trichisanthes cucumerina*, *Sauromatum venosum* are widely used as antidote. Several plant species e.g. *Curcuma amada*, *Cayratia trifolia*, *Arisaema tortuosum* and *Chlorophytum tuberosum* are used for curing bone fracture. *Tacca* which is reported for the first time just little while ago in Rajasthan, (India) (Sharma, S. (2005), has medicinal value of curing severe headache or migraine. *Leea macrophylla* is reported to be anti cancerous .It is also observed that some tuberous plant species are used by tribals to cure various sexual disease , menorrhage to regularize menstruation , to increase fertility etc. the knowledge of tribals about contra receptive, which is one of the informal innovation by them, is quite relevant in present day situation . In this context *Gloriosa superba* used to develop sterility. *Curculigo orchiooides* incareas sexual vigor. *Dioscorea bulbifera* is used by tribal ladies as contra receptive. *Arisaema tortuosum* , *Ampelocissus latifolia* , *Curculigo orchiooides* *Corallocarpus epigaeus* *Colocasia esculenta* , *Curcuma amada*, *Dioscorea bulbifera*, *Dioscorea pentaphylla* , *Eulophia ochreatea* , *Leea macrophylla*, *Withania somnifera*, *Ruelia tuberosa* are common important plants which are used by tribals to cure various ailments related to digestive tract like constipation, indigestion, abdominal pain, dysentery etc. Skin diseases like wounds, tumors, boils, sunburn, cut, injury, and carbuncle are among tribals. Few important plant species which cure these diseases are *Sauromatum venosum*, *Cayratia trifolia*, *Raphanus sativus*, *Zingiber officinale*, *Corallocarpus epigaeus* and *Crinum asiaticum*. Most of the skin diseases may be cured by application of a poultice or a paste which is applied locally. Various ailments related to respiration like cough, cold, tuberculosis and asthma are cured by the tribals either using single herb or mixture of more than one herb i.e. *Costus speciosus*, *Dioscorea bulbifera*, *Dioscorea pentaphylla*, *Urginea indica*, *Ampelocissus latifolia*. Stones in the urinary tract, bladder, kidney and inflammation in urinary tract are some common disease of urinary system in the tribals of the study area which is cured by *Ceropegia bulbosa*. *Eulophia ochreatea* is reported for curing fever. *Corallocarpus epigaeus* is used for curing typhoid. *Costus speciosus*, *Crinum asiaticum*, *Ceropegia bulbosa* are widely used to cure various ailments of ear. *Asparagus racemosus*, *Cayratia trifolia* and *Withania somnifera* are widely used for curing diabetes. *Ampelocissus latifolia* .is effective against gout. *Costus speciosus*, *Euphorbia fusiformis* *Withania somnifera* are used against rheumatism. *Ampelocissus latifolia* , *Chlorophytum tuberosum*, *Daucas carota* are used as tonic . Due to absence of proper hygiene, tribals are infected by nematodes, so they use *Arisaema tortuosum*, *Curculigo orchiooides* , *Gloriosa superba*, *Urginea indica*, *Pueraria tuberosa* against nematodal infection.(Appendix 3). These highly interesting finding require further research, while the efficacy of the various indigenous remedies will need to be subjected to pharmacological validation. During the ethnobotanical survey, observation on importance of tuberous plants has been observed as presented in Appendix 2. It is observed that the dosages and duration of medicine generally depend on the intensity of the disease and age of patient. It is observed that tribal harvest that plant part used for medicinal purpose at particular growth period or season e.g. before flowering and fruiting period etc. presumably to obtain maximum concentration of the active principle. As tuberous plants remain in dormant phase and have a limited period for completing their life cycle, tribal preserve the tuber for various remedies, which is harvested in their particular period. Hence, the tribals have a specified way of collecting the herbs, preparing and applying the medicine. It is observed that single plant species or a combination of different plant species is used for curing various diseases . [19,20]

IV.CONCLUSION

We think that the present status of the economically and medicinally important plants of the study area needs to be determined in order to develop plans for their protection. Improved awareness of conservation issues is needed. Proper documentation of indigenous knowledge about the plants could be supportive in achievement of objectives. Local cultivation of medicinal plants and other economic species can play an important role in economic development of the area. For sustainable and long term conservation of natural resources of the area; there is a need to actively involve the quiescence of local people in evaluation, planning, implementation and monitoring processes as they are the best judges of the area.[21]

REFERENCES

1. "Ethnobotany". www.fs.fed.us. Retrieved 2 May 2018.
2. ^{a b} "Ethnobotany". www.eplantscience.com. Archived from the original on 14 April 2018. Retrieved 2 May 2018.
3. ^a Kandell, Jonathan (13 April 2001). "Richard E. Schultes, 86, Dies; Trailblazing Authority on Hallucinogenic Plants". The New York Times. Retrieved 2 May 2018.
4. ^a Kochhar, S. L. (2016). *Economic Botany: A Comprehensive Study* (5 ed.). Cambridge University. p. 644. ISBN 9781316675397.
5. ^{a b} Soejarto, D.D.; Fong, H.H.S.; Tan, G.T.; Zhang, H.J.; Ma, C.Y.; Franzblau, S.G.; Gyllenhaal, C.; Riley, M.C.; Kadushin, M.R.; Pezzuto, J.M.; Xuan, L.T.; Hiep, N.T.; Hung, N.V.; Vu, B.M.; Loc, P.K.; Dac, L.X.; Binh, L.T.; Chien, N.Q.; Hai, N.V.; Bich, T.Q.; Cuong, N.M.; Southavong, B.; Sydara, K.; Bouamanivong, S.; Ly, H.M.; Thuy, Tran Van; Rose, W.C.; Dietzman, G.R. (2005). "Ethnobotany/Ethnopharmacology and mass bioprospecting: Issues on intellectual property and benefit-sharing" (PDF). *Journal of Ethnopharmacology*. 100 (1–2): 15–



22. doi:10.1016/j.jep.2005.05.031. PMID 15993554. Archived from the original (PDF) on 2016-01-07. Retrieved 2013-06-01.
6. ^{a b} White, James T. (1931). *The National cyclopædia of American biography ... v.21*. University of Michigan.
7. ^a Ponman, Bruce E; Bussmann, Rainer W. (2012). *Medicinal Plants and the Legacy of Richard E. Schultes (PDF)*. Missouri Botanical Garden. ISBN 978-0984841523.
8. ^a Mazal, Otto. "Dioscorides: De Materia Medica". Uchicago.edu. University of Chicago. Retrieved 2 May 2018.
9. ^a Crosby, Alfred W. "The Columbian Exchange: Plants, Animals, and Disease between the Old and New Worlds". nationalhumanitiescenter.org. National Humanities Center.
10. ^a "Sitka spruce". www.for.gov.bc.ca. British Columbia. Retrieved 2 May 2018.
11. ^a Fatur, Karsten (June 2017). "'Hexing Herbs' in Ethnobotanical Perspective: A Historical Review of the Uses of Anticholinergic Solanaceae Plants in Europe". *Economic Botany*. 74 (2): 140–158. doi:10.1007/s12231-020-09498-w. ISSN 0013-0001. S2CID 220844064.
12. ^a Han F. Vermeulen (2015). *Before Boas: The Genesis of Ethnography and Ethnology in the German Enlightenment Critical Studies in the History of Anthropology Series*. University of Nebraska Press. ISBN 9780803277380.
13. ^a "Captain James Cook (1728-1779)". PlantExplorers.com.
14. ^a G.E. Wickens (2012). *Economic Botany: Principles and Practices (illustrated ed.)*. Springer Science & Business Media. p. 8. ISBN 9789401009690.
15. ^a Andrea Pieroni, Cassandra L. Quave, ed. (2014). *Ethnobotany and Biocultural Diversities in the Balkans: Perspectives on Sustainable Rural Development and Reconciliation (illustrated ed.)*. Springer. p. 1. ISBN 9781493914920.
16. ^a *The Shaman's Apprentice Forest*. South American Explorer, Autumn 1988.
17. ^a Sood, S.K., Nath, R. and Kalia, D.C. 2001. *Ethnobotany of Cold Desert Tribes of Lahoul-Spiti (N.W. Himalaya)*. Deep Publications, New Delhi.
18. ^a *Wind in the Blood: Mayan Healing and Chinese Medicine*, by Hernan Garcia, Antonio Sierra, Hilberto Balam, and Jeff Connant
19. ^a Ethridge, Robbie (1996). "Review of: *Iroquois Medical Botany*. By James W. Herrick". *American Indian Culture and Research Journal*. 20 (2). American Indian Culture and Research Center, University of California: 213.
20. ^a Herrick, J. W. (1995). *Iroquois Medical Botany*. Syracuse, NY: Syracuse University Press.
21. ^a Jabr, Ferris (14 September 2016). "Could Ancient Remedies Hold the Answer to the Looming Antibiotics Crisis?". *The New York Times*. Retrieved 2018-10-26.