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Short Communication

The medicinal flora of Majouri-Kirchi forests (Jammu and Kashmir State), India

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Introduction

The Udhampur district lies in the northernmost portion of India, approximately at 75° 7′ to 75° 10′ longitude east and 33° 54′ to 33° 57′ latitude north in the State of Jammu and Kashmir. The total area of the district is 2549 km^2; it has a hilly topography ranging from 300 m to 2780 m above sea level. The region consists of limestone, quartzites, grit and earthy clay. The soil is sandy except in ravines and densely forested areas. The tract is extremely hilly, arduous and rugged. The flora of the district has recently been described by Swami and Gupta (1988a,b, 1989a,b) while the economically useful plants of the region have been described by Kapur (1990a,b).

Methodology

The sources listed above provide the data shown in Table 1. The plants have been arranged in families according to the Bentham and Hooker system of classification; the nomenclature has been adjusted to take into account the most recent work in the area (Cope, 1982; Kumar and Subramanium, 1986; Bennet, 1987). Using the method of regression and residual analysis developed by Moerman (1991), we carried out a regression analysis of the number of medicinal species per family (MS) on the total number of species in each family (TS) for the 106 flowering plant families in the region. The regression equation is

$$MS = 0.72 + 0.53 * TS$$

According to this equation and under the null hypothesis (essentially saying that the selection of medicinal plants is random) the number of medicinal species per family should be equal to the total number of species in the family times 0.53 plus 0.72. These predicted values are shown in Table 1. Subtracting the predicted value from the actual value gives us the residual value for each data point. The residuals are also shown in Table 1; the families are shown in order of the decreasing value of these residuals. The table is organized in the same manner as is Appendix A in Moerman's paper on North American medicinal plants (1991, pp. 33–37) and may be compared to it. The data are shown in Fig. 1 where the residual may be visualized as the vertical distance from the data point to the regression line.

Discussion

Residuals range from 19.6 to −18.3. Families with large positive residuals are ones used more often than chance would allow, while families with large negative values are used less than chance would allow. Among families with a larger than expected number of medicinals are Asteraceae, Euphorbiaceae, Ranunculaceae and Lamiaceae. Among the low use families are Poaceae, Papilionaceae, Urticaceae, Anacardiaceae and Brassicaceae.

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TABLE 1

REGRESSION ANALYSIS OF 106 JAMMU AND KASHMIR PLANT FAMILIES

Rank	Family	Total species (TS)	Medicinal species (MS)	Predicted	Residual
1	Asteraceae	64	54	34.4	19.6
2	Euphorbiaceae	19	17	10.7	6.3
3	Ranunculaceae	22	18	12.3	5.7
4	Lamiaceae	37	25	20.2	4.8
5	Liliaceae	9	9	5.5	3.5
6	Solanaceae	11	10	6.5	3.5
7	Amaranthaceae	13	11	7.6	3.4
8	Polygonaceae	16	12	9.2	2.8
9	Moraceae	7	7	4.4	2.6
10	Mimosaceae	6	6	3.9	2.1
11	Rubiaceae	16	11	9.2	1.8
12	Apiaceae	18	12	10.2	1.8
13	Caesalpiniaceae	7	6	4.4	1.6
14	Rhamnaceae	7	6	4.4	1.6
15	Malvaceae	9	7	5.5	1.5
16	Acanthaceae	17	11	9.7	1.3
17	Scrophulariaceae	19	12	10.7	1.3
18	Menispermaceae	3	3	2.3	0.7
19	Zingiberaceae	3	3	2.3	0.7
20	Orchidaceae	3	3	2.3	0.7
21	Hypericaceae	3	3	2.3	0.7
22	Meliaceae	3	3	2.3	0.7
23	Geraniaceae	5	4	3.4	0.6
24	Caryophyllaceae	7	5	4.4	0.6
25	Asclepiadaceae	7	5	4.4	0.6
26	Nyctaginaceae	2	2	1.8	0.2
27	Crassulaceae	2	2	1.8	0.2
28	Lythraceae	2	2	1.8	0.2
29	Aceraceae	2	2	1.8	0.2
30	Dioscoreaceae	2	2	1.8	0.2
31	Loganiaceae	2	2	1.8	0.2
32	Onagraceae	2	2	1.8	0.2
33	Philadelphaceae	2	2	1.8	0.2
34	Saxifragaceae	2	2	1.8	0.2
35	Balsaminaceae	2	2	1.8	0.2
36	Aquifoliaceae	2	2	1.8	0.2
37	Violaceae	2	2	1.8	0.2
38	Rosaceae	23	13	12.8	0.2
39	Rutaceae	6	4	3.9	0.1
40	Leeaceae	1	1	1.2	−0.2
41	Smilacaceae	1	1	1.2	−0.2
42	Parnassiaceae	1	1	1.2	−0.2
43	Zygophyllaceae	1	1	1.2	−0.2
44	Iridaceae	1	1	1.2	−0.2
45	Papaveraceae	1	1	1.2	−0.2
46	Martyniaceae	1	1	1.2	−0.2
47	Punicaceae	1	1	1.2	−0.2
48	Portulacaceae	1	1	1.2	−0.2
49	Morinaceae	1	1	1.2	−0.2
50	Plumbaginaceae	1	1	1.2	−0.2
51	Podophyllaceae	1	1	1.2	−0.2
52	Cuscutaceae	1	1	1.2	−0.2
53	Buxaceae	1	1	1.2	−0.2
54	Bombacaceae	1	1	1.2	−0.2
55	Droseraceae	1	1	1.2	−0.2
56	Bignoniaceae	1	1	1.2	−0.2
57	Campanulaceae	1	1	1.2	−0.2
58	Cannabaceae	1	1	1.2	−0.2
59	Commelinaceae	1	1	1.2	−0.2
60	Cornaceae	1	1	1.2	−0.2
61	Cactaceae	1	1	1.2	−0.2
62	Araliaceae	1	1	1.2	−0.2
63	Arecaceae	1	1	1.2	−0.2
64	Hippocastanaceae	1	1	1.2	−0.2
65	Haemodoraceae	1	1	1.2	−0.2
66	Ericaceae	1	1	1.2	−0.2
67	Begoniaceae	1	1	1.2	−0.2
68	Plantaginaceae	3	2	2.3	−0.3
69	Lauraceae	3	2	2.3	−0.3
70	Chenopodiaceae	3	2	2.3	−0.3
71	Myrsinaceae	3	2	2.3	−0.3
72	Flacourtiaceae	3	2	2.3	−0.3
73	Polygalaceae	3	2	2.3	−0.3
74	Valerianaceae	3	2	2.3	−0.3
75	Oxalidaceae	5	3	3.4	−0.4
76	Apocynaceae	7	4	4.4	−0.4
77	Primulaceae	7	4	4.4	−0.4
78	Oleaceae	9	5	5.5	−0.5
79	Berberidaceae	2	1	1.8	−0.8
80	Salicaceae	2	1	1.8	−0.8
81	Linaceae	2	1	1.8	−0.8
82	Loranthaceae	2	1	1.8	−0.8
83	Dipsacaceae	2	1	1.8	−0.8
84	Fagaceae	2	1	1.8	−0.8
85	Elaeagnaceae	2	1	1.8	−0.8
86	Celastraceae	2	1	1.8	−0.8
87	Thymelaeaceae	4	2	2.8	−0.8
88	Tiliaceae	6	3	3.9	−0.9
89	Caprifoliaceae	8	4	4.9	−0.9
90	Convolvulaceae	12	6	7.0	−1.0
91	Ulmaceae	3	1	2.3	−1.3
92	Ehretiaceae	3	1	2.3	−1.3
93	Fumariaceae	3	1	2.3	−1.3
94	Combretaceae	3	1	2.3	−1.3
95	Araceae	5	2	3.4	−1.4
96	Boraginaceae	9	4	5.5	−1.5
97	Verbenaceae	11	5	6.5	−1.5
98	Gentianaceae	4	1	2.8	−1.8
99	Sapindaceae	4	1	2.8	−1.8
100	Cyperaceae	11	4	6.5	−2.5
101	Cucurbitaceae	8	2	4.9	−2.9
102	Brassicaceae	16	6	9.2	−3.2
103	Anacardiaceae	9	2	5.5	−3.5
104	Urticaceae	8	1	4.9	−3.9
105	Papilionaceae	56	25	30.2	−5.2
106	Poaceae	79	24	42.3	−18.3

These are all relatively large families. One might say, therefore, that this sort of analysis *obscures* the contributions of small families. But small families produce relatively few medicines; while

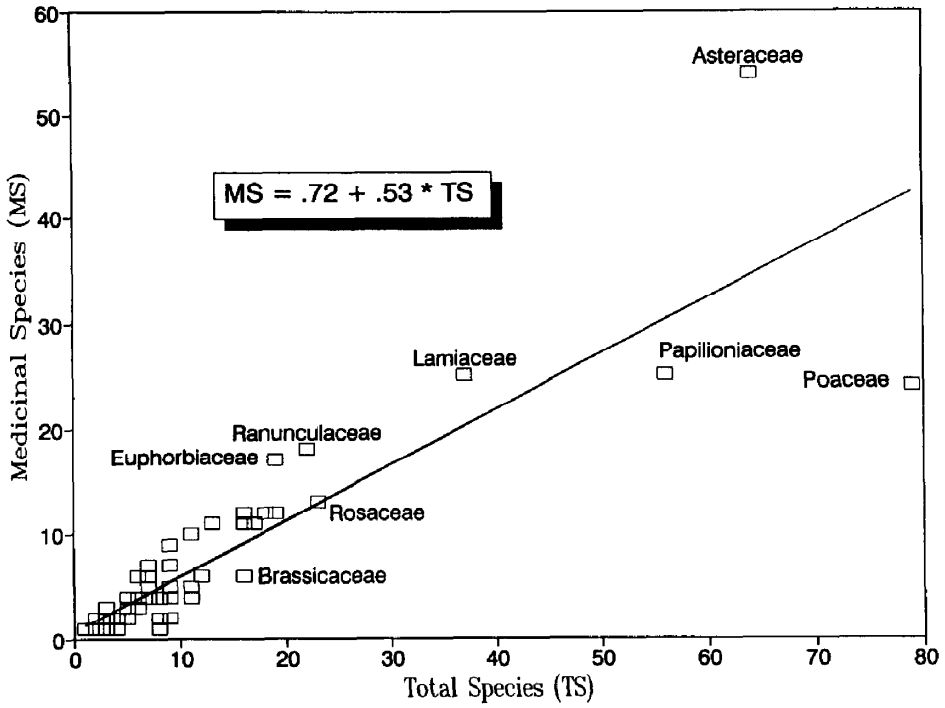

Fig. 1. Regression plot for 106 plant families in the Majouri-Kirchi forest tract in Jammu and Kashmir showing medicinal species vs. total species. The points plotted are the actual values of the number of species and medicinal species in each family. The residual value is represented by the vertical distance from the point to the regression line. Residuals above the line are positive while those below the line are negative. Several of the families discussed in the text are labeled.

the larger 53 Indian families have 656 species of which 400 are medicinal, the smaller 53 have only 83 of which 66 are medicinal. (By way of comparison, in North America, the larger 116 families have 15,851 species of which 2023 are medicinal, while the smaller 116 have only 419 species of which 72 are medicinal.) Alternatively, then, one may say that this method *reveals* the respective contributions of the larger families, and, in particular, allows us to differentiate those large families which produce many medicines (e.g., Asteraceae) from those which produce few (e.g., Poaceae). This is not to say that the medicinal species found in small families are not 'interesting,' only that those families are not substantial producers of traditional medicines. One could compare families of intermediate size, or small ones, in the same manner.

There are several points of difference between the medicinal floras of Jammu and Kashmir and of North America. Not surprisingly, the flora of North America is a good deal larger than the flora of this small region in India. There are 232 families in North America, 106 here. There are well over 16,000 species in North America, while there are only 739 in the Majouri-Kirchi forests. In North America, some 13% of the flora has been used medicinally by Native Americans (2144 of 16,270 species); in Jammu and Kashmir, nearly 64% are so used (466 of 731). In North America, many families (over 90) produce no species used medicinally; in Jammu and Kashmir each of the 106 families produces at least one medicinally used species.

Given these differences, the following similarities seem quite striking. Four families appear on the 'top 10' lists of high-use families in both areas: Asteraceae (first on both), Ranunculaceae, Lamiaceae and Liliaceae. Solanaceae ranks 6th in Jammu and Kashmir and 13th in North America. These families have many species used medicinally on both sides of the world. Two families occur on both 'bottom 10' lists: Poaceae (last on both) and Cyperaceae. Poaceae, which only rarely produces biologically active defensive chemicals, is the primary source of human staple foods.

A few notable differences occur in the placement of families on these lists. Rosaceae, a highly favored source of medicines in North America

(second on the list, with 115 of a total 577 species used medicinally), is well down the list in Jammu and Kashmir in 37th place; even so, 13 of its 23 species are used medicinally. Most striking perhaps is the different placement of Euphorbiaceae which is second in Jammu and Kashmir (with 17 of its 19 species used medicinally) and very near the bottom of the list in North America, in position 222 (with only 23 of its 264 species used medicinally).

There is a similar situation with the pulses which is a bit more complex since there are some differences in the classifications used with the data reported here and the data reported by Moerman. The North American data for the pulses are combined into the family Fabaceae, which includes three subfamilies, the Mimosoideae, the Caesalpinioideae and the Papilionoideae. These three North American subfamilies are reported as three families in the Indian data. Combining them for the purpose of comparison yields a group with 69 total species and 37 medicinal species. Applying the regression equation, this would give a predicted number of medicinal species of 37.3 with a residual of 0.3; this 'family' would be ranked 26th on Table 1, very much in the middle. By contrast, the Fabaceae family in North America is third from the bottom of the list with only 108 of its 1225 species used medicinally. This family is apparently much more likely to be a source of medicines in India than in North America.

Among important North American medicinal families which do not occur at all in the Majouri Kirchi forests of Jammu and Kashmir State is Corylaceae.

Conclusions

This simple method of comparison allows us to identify (a) plant families which are apparently substantial sources of traditional medicines worldwide (such as Asteraceae), (b) families with varying medicinal usage in different places (such as Euphorbiaceae and Fabaceae), (c) families which are apparently never substantial sources of traditional medicines (such as Poaceae). These comparisons can easily be extended to other areas with extensive botanical and ethnobotanical information.

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