CHAPTER IV

Analysis and Interpretation

4.1 Drug discovery in Medicinal Plants Research – Trend Analysis

Table 1 Literature on Drug discovery in Medicinal Plants – Yearwise Distribution

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Table 1 shows the distribution of literature on Drug discovery in Medicinal plants over the years from 2001 to 2010. The maximum output is in the year 2010 and the minimum output is in the year 2001. There is continuous growth in the research productivity from the year 2001 to 2010. This shows that research in the subject Drug discovery in Medicinal plants is in the increase.
Figure 1 Research in Drug Discovery in Medicinal Plants - Yearwise Trend
Table 2 Literature on Drug discovery in Medicinal Plants – Growth rate

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Table 2 depicts the growth of research in drug discovery in Medicinal plants during the decade from 2001 to 2010. Though drug discovery in Medicinal plants is an old one, still research persists. Also it can be found from table 2 that the growth rate is not uniform during the years of study. The maximum growth rate is in the year 2007 and the minimum growth rate is in the year 2006. This shows that there is a sudden decrease in research in the subject area Drug discovery in Medicinal plants during the years 2006 and 2010.
Table 3  Literature on Drug discovery in Medicinal Plants –

Regression Analysis

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Straight Line eqn \( Y_c = a + bX \)

Since \( \sum x = 0 \)

\[
a = \frac{\sum Y}{N} = \frac{7324}{10} = 732.4
\]

\[
b = \frac{\sum XY}{\sum x^2} = \frac{7958}{110} = 72.35
\]

Estimated literature in 2015 is when \( X = 2015 - 2005 = 10 \)

\[
= 732.4 + 72.35 \times 10 = 732.4 + 723.5 = 1455.9
\]

Estimated literature in 2020 is when \( X = 2020 - 2005 = 15 \)
\[ 732.4 + 72.35 \times 15 = 732.4 + 1085.25 = 1817.65 \]

This shows that the research productivity in Drug Discovery in Medicinal Plants will almost double in the year 2020.

### 4.2 Authorship Pattern

**Table 4 Literature on Drug discovery in Medicinal Plants – Authorship pattern**

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Research productivity on Drug discovery in Medicinal Plants are available as single authored publications to as many as publications by 44 authors. Publications by four authors is maximum. Also it can be found from the table that, as the number of authors increases from one to four, there is increase in the publication count and as the number of authors increases above four, the publication count decreases. This shows that the ideal and maximum number of authors for a publication in the subject Drug discovery in Medicinal Plants is 4. That is, the maximum number of collaborators in a publication is 4.
Figure 2 Authorship Pattern

![Authorship Pattern Graph]

- **X-axis**: Number of Authors
- **Y-axis**: Count

The graph shows the distribution of papers according to the number of authors, with a peak at 1 author and a decline as the number of authors increases.
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Single authored publications are maximum in the year 2009 and minimum in the year 2004. Joint authorship publications are maximum in the year 2008 and minimum in the year 2001. But there is gradual growth in collaborative publications starting from the year 2001 till the year 2010. This implies that collaborative publications may replace solo research.
Figure 3 Collaborative Authorship
Table 7  Single Authored Publication – Time Series Analysis

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<td>110</td>
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Straight Line eqn  \[ Y_c = a + bX \]

Since \[ \sum x = 0 \]

\[ a = \frac{\sum Y}{N} = \frac{561}{10} = 56.1 \quad b = \frac{\sum XY}{\sum x^2} = \frac{76}{110} = 0.69 \]

Estimated literature in 2015 is when \( X = 2015 - 2005 = 10 \)

\[ = 56.1 + 0.69 \times 10 = 56.1 + 6.9 = 63 \]

Estimated literature in 2020 is when \( X = 2020 - 2008 = 15 \)

\[ = 56.1 + 0.69 \times 15 = 56.1 + 10.35 = 66.45 \]

This shows that the growth in the single authored publications in the subject Drug Discovery in Medicinal Plants will almost be very negligible in the year 2020.
Table 8 Joint Authored Publication – Time Series Analysis

<table>
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<tr>
<th>Year</th>
<th>Pubs(Y)</th>
<th>(X)</th>
<th>$X^2$</th>
<th>XY</th>
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</thead>
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<td>110</td>
<td>753</td>
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Straight Line eqn \( Y_c = a + bX \)

Since \( \sum x = 0 \)

\[ a = \frac{\sum Y}{N} = \frac{1027}{10} = 102.7 \]

\[ b = \frac{\sum XY}{\sum x^2} = \frac{753}{110} = 6.85 \]

Estimated literature in 2015 is when \( X = 2015 - 2005 = 10 \)

\[ = 102.7 + 6.85 \times 10 = 102.7 + 68.5 = 171.2 \]

Estimated literature in 2020 is when \( X = 2020 - 2005 = 15 \)

\[ = 102.7 + 6.85 \times 15 = 102.7 + 102.75 = 205.2 \]

This shows that the joint authored publications in Drug Discovery in Medicinal Plants will almost double in the year 2020.
Table 9  Collaborative Publication – Time Series Analysis

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<th>XY</th>
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Straight Line eqn  \( Y_c = a + bX \)

Since \( \sum x = 0 \)

\[ a = \frac{\sum Y}{N} = \frac{5734}{10} = 573.4 \]

\[ b = \frac{\sum XY}{\sum x^2} = \frac{7126}{110} = 64.78 \]

Estimated literature in 2015 is when \( X = 2015 - 2005 = 10 \)

\[ = 573.4 + 64.78 \times 10 = 573.4 + 647.8 = 1221.2 \]

Estimated literature in 2020 is when \( X = 2020 - 2005 = 15 \)

\[ = 573.4 + 64.78 \times 15 = 573.4 + 971.7 = 1545.1 \]

This shows that the Collaborative publications in Drug Discovery in Medicinal Plants will almost double in the year 2015.
AUTHORSHIP PATTERN- DEGREE OF COLLABORATION

In recent years there is a trend towards collaboration in research in almost all pure and applied sciences. Subramanian\textsuperscript{103} has deduced a formula for calculating the degree of collaboration as

\[ C = \frac{N_m}{N_m + N_s} \]

where \( C \)=degree/extent of collaboration

\( N_s \)=number of single authored papers

\( N_m \)=number of multi authored papers.

Thus the percentage of collaboration can be arrived at by applying the formula as given below:

\[ C = \frac{N_m}{N_M + N_s} \]

Table 10  Degree of Collaboration

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<tr>
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<th>Multi (Nm)</th>
<th>Degree of Collaboration Nm/Nm+Ns</th>
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The degree of collaboration in publishing pattern of Drug Discovery in Medicinal Plants varies from 0.87 to 0.96. The Degree of Collaboration is maximum in the year 2010 showing that collaborative research will be more in the forth coming years.
### 4.3 Geographical Distribution of Authors

**Table 11 Countries of Authors**

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takes lead with 1393 publications forming 19.02 per cent (Nearly one fifth) of the total world output. The second ranked country is India forming 10.45 per cent and this is followed by China forming 8.08 per cent of the world output. India is in the second place with 765 publications. Here it is to be noted that research productivity in Drug Discovery in Medicinal plants from Asian Countries is more when compared to the rest of the world. Even small under developed countries like Iran and Turkey have considerable publications.
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Table 12 shows that trend of publication in Drug Discovery in Medicinal Plants from various countries of the world. The leading country USA do not show any uniform growth or decline. But India shows a gradual growing trend while China shows a growing trend from 2005 onwards. Other countries like Japan, Germany, Italy, England etc do not

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4.4 Type of Publications

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</table>

Research communications in the field of Drug Discovery in Medicinal Plants are published in various formats, of which, journal article is maximum forming 78.50 per cent of the total output. The second ranked type is reviews followed by meeting abstracts forming 14.81 per cent and 3.97 per cent respectively.
4.5 Language of Publication

Table 14 Language of Publication

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<th>Language</th>
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<tr>
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<td>Serbo-Croatian</td>
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Drug Discovery in Medicinal Plants literature is available in 15 languages of which English ranked first covering 96.83 per cent of the total output. This shows that English forms the *lingua franca* with regard to the literature output on Drug Discovery in Medicinal Plants. The second major contribution is in Portuguese followed by German and Japanese. Japanese ranks fourth followed by Spanish. Here it is to be noted that Indian languages does not find any place in the research output on Drug Discovery in Medicinal Plants. Indian contributions are there in English, yet Indian languages did not find place in Drug Discovery in Medicinal Plants literature.
### 4.6 Productivity Journals in Drug Discovery in Medicinal Plants

#### Table 15 Core Journals

<table>
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<th>S.No</th>
<th>Journal</th>
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<td>JOURNAL OF PHARMACEUTICAL AND BIOMEDICAL ANALYSIS</td>
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<td>JOURNAL OF MEDICINAL PLANTS RESEARCH</td>
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<td>23.</td>
<td>FOOD AND CHEMICAL TOXICOLOGY</td>
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<td>27.</td>
<td>CURRENT DRUG METABOLISM</td>
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<td>Year</td>
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The total number of journals that have contributed research productivity in the subject Drug Discovery in Medicinal Plants is 1670, of which, 49 are core in nature. The journal that ranked first is Journal of Ethnopharmacology from Ireland. The second ranked journal is PHYTOTHERAPY RESEARCH which is published from England. The third ranked journal is JOURNAL OF MEDICINAL CHEMISTRY which is
published from USA. Here it is to be noted that among the total journals that had published the research findings in Drug discovery in Herbal Medicine, nearly 3 per cent are core in nature. Hence it is found necessity to check whether the same trend prevails in other years also.

**Table 16 Core Journals – 2001**

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<tr>
<td>JPC-JOURNAL OF PLANAR CHROMATOGRAPHY-MODERN TLC</td>
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<td>YAKUGAKU ZASSHI-JOURNAL OF THE PHARMACEUTICAL SOCIETY OF JAPAN</td>
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<td>JOURNAL OF COMPUTER-AIDED MOLECULAR DESIGN</td>
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In the year 2001, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 241 of which the core journals are 27 in number. That is, among the journals that have contributed to Drug Discovery in Herbal medicine, 10 per cent are core in nature. The first ranked journal is JOURNAL OF ETHNOPHARMACOLOGY that is published from Ireland and the second ranked journal is PHYTOTHERAPY RESEARCH from England. The third ranked journal is JOURNAL OF MEDICINAL CHEMISTRY from USA.
Table 17  Core Journals – 2002

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In the year 2002, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 260 which is double to that of the previous year and the core journals are 28 in
number. That is, among the journals that have contributed to Drug Discovery in Herbal medicine, nearly 10 per cent are core in nature. Here it is interesting to note that, though the total number of contributing journals have increased, the percentage of core journals is the same. The first ranked journal is JOURNAL OF MEDICINAL CHEMISTRY that is published from USA and the second ranked journal is JOURNAL OF ETHNOPHARMACOLOGY from Ireland. The third ranked journal is PHYTOMEDICINE from Germany.
### Table 18  Core Journals – 2003

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</table>

In the year 2003, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 282 of which the core journals are 25 in number. That is, among the journals that have contributed to Drug Discovery in Herbal medicine, 10 per cent are core in nature. The first ranked journal is JOURNAL OF
ETHNOPHARMACOLOGY that is published from Ireland and the second ranked journal is PHYTOTHERAPY RESEARCH from England. The third ranked journal is JOURNAL OF MEDICINAL CHEMISTRY from USA.
In the year 2004, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 345 of which the core journals are 28 in number. Here it is interesting to note that, though the total number of contributing journals have increased, the

<table>
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<tr>
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percentage of core journals remains the same. The first ranked journal is JOURNAL OF MEDICINAL CHEMISTRY from USA and the second ranked journal is JOURNAL OF ETHNOPHARMACOLOGY that is published from Ireland. The third ranked journals is AMERICAN JOURNAL OF CHINESE MEDICINE from USA.
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In the year 2005, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 364 of which the core journals are 32 in number. That is, among the journals that have contributed to Drug Discovery in Herbal medicine, 11 per cent are core in nature. Here it is interesting to note that, though the total number of contributing journals have increased, the percentage of core journals have also increased. The first ranked journal is JOURNAL OF ETHNOPHARMACOLOGY that is published from Ireland and the second ranked journal is JOURNAL OF MEDICINAL CHEMISTRY from USA. The third ranked journals is PHYTOTHERAPY RESEARCH from England.
Table 21 Core Journals – 2006

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In the year 2006, among the journals that have contributed to research productivity Drug discovery in Medicinal plants the core journals are 26 in number. The leading journal this year is JOURNAL OF ETHNOPHARMACOLOGY from Ireland and this is followed by
BIOORGANIC & MEDICINAL CHEMISTRY published from England. The third ranked journal is PHYTOMEDICINE from Germany.
### Table 22  Core Journals – 2007

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In the year 2007, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 481 of which the core journals are 32 in number. That is, among the journals that have contributed to Drug Discovery in Herbal medicine, 7 per cent are core in nature. Here it is interesting to note that, though the total number of contributing journals have increased, the percentage of core journals have has decreased. The first ranked journal is JOURNAL OF ETHNOPHARMACOLOGY that is published from Ireland and the second ranked journal is PHYTOMEDICINE from England. The third ranked journals is PHYTOTHERAPY RESEARCH from England.
Table 23  Core Journals – 2008

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In the year 2008, the total number of journals that have contributed to research productivity in Drug Discovery in Medicinal Plants is 481 of which the core journals are 39 in number. The first ranked journal is JOURNAL OF ETHNOPHARMACOLOGY that is published from Ireland and the second ranked journal is BIOORGANIC & MEDICINAL CHEMISTRY from England. The third ranked journals is JOURNAL OF MEDICINAL CHEMISTRY from England.
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In the year 2009, among the 560 journals that have contributed to research productivity Drug discovery in Medicinal plants the core journals are 48 in number. The leading journal this year is JOURNAL OF ETHNOPHARMACOLOGY from Ireland and this is followed by PHYTOTHERAPY RESEARCH published from England. The third ranked journal is JOURNAL OF MEDICINAL PLANTS RESEARCH from USA.
Table 25  Core Journals – 2010

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<td>18</td>
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<tr>
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<td>17</td>
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<tr>
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<tr>
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<td>9</td>
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<tr>
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<td>9</td>
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<tr>
<td>REVISTA BRASILEIRA DE FARMACOGNOSIA-BRAZILIAN JOURNAL OF PHARMACOGNOSY</td>
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<td>DRUG METABOLISM AND DISPOSITION</td>
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<tr>
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<tr>
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<tr>
<td>FITOTERAPIA</td>
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<td>ACTA POLONIAE PHARMACEUTICA</td>
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<tr>
<td>RAPID COMMUNICATIONS IN MASS SPECTROMETRY</td>
<td>6</td>
</tr>
<tr>
<td>Journal</td>
<td>Rank</td>
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<tr>
<td>---------------------------------------------------------------</td>
<td>------</td>
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<tr>
<td>JOURNAL OF ETHNOBIOLOGY AND ETHNOMEDICINE</td>
<td>5</td>
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<tr>
<td>PLOS ONE</td>
<td>5</td>
</tr>
<tr>
<td>INDIAN JOURNAL OF EXPERIMENTAL BIOLOGY</td>
<td>5</td>
</tr>
<tr>
<td>JOURNAL OF COMPUTER-AIDED MOLECULAR DESIGN</td>
<td>5</td>
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</table>

In the year 2010, among the 582 journals that have contributed to research productivity Drug discovery in Medicinal plants the core journals are 39 in number. The leading journal this year is JOURNAL OF ETHNOPHARMACOLOGY from Ireland and this is followed by JOURNAL OF MEDICINAL PLANTS RESEARCH published from USA. The third ranked journal is PLANTA MEDICA from England.

Throughout the study period of 10 years JOURNAL OF ETHNOPHARMACOLOGY ranks first most of the four years. Only in the year 2006, it is in the second place.
4.7 Application of Bradford’s Law

Table 26  Bradford’s Law

<table>
<thead>
<tr>
<th>Zone</th>
<th>No of Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>49</td>
</tr>
<tr>
<td>Zone 2</td>
<td>234</td>
</tr>
<tr>
<td>Zone 3</td>
<td>1387</td>
</tr>
</tbody>
</table>

In 1948, Bradford, based on his analytical approach, argued that the ratio of the zone size will be as $1:n:n^2$. In his analytical approach, he assumed that the collection of journals is ranked (or arranged) in decreasing productivity (i.e., in terms of number of articles it contains, on a given subject). He then divided these journals into $k$ groups/zones, such that

$$m_1r_1=m_2r_2=m_3r_3=...=m_kr_k \quad (A)$$

where $m_i$ is the number of journals and $r_i$ is the average number of articles per journal in the $i^{th}$ zone. Thus from the relation (A), we have:

$$m_{i-1}r_{i-1}=m_ir_i \quad i=2,3,...,k$$

and with the supposition that $n_{i-1}=n_i=n$ where $n_{i-1}=r_{i-1}/r_i$

$$i=2,3,...,k$$

he suggested that the ratio of the zone size will be $1:n:n^2$. This $n$ is known as BRADFORD MULTIPLIER. In the present study, the total
journals arranged in the order of the rank are divided into three zones each containing the same number of publications, the number of journals in each zone are in the ratio 49:234:1387:: 1:4.78:28.36 which is not in the form 1:n:n² deviating Bradford’s Law.

**BRADFORD’S BIBLIOGRAPH**¹⁰⁴

Bradford also plotted graphs of the cumulative number of source items (R(n) versus the logarithm of the cumulative number of journals (log n). The resulting graph for Applied Geophysics and Lubrication began as a rising curve and then continued in a horizontal straight line. The rising part of the curve represents the nucleus of highly productive journals.

Table 27  Bradford’s Bibliograph

<table>
<thead>
<tr>
<th>No of Papers</th>
<th>No of Journals</th>
<th>Cum (n)</th>
<th>Log (n)</th>
</tr>
</thead>
<tbody>
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<td>796</td>
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<tr>
<td>2 Papers</td>
<td>304</td>
<td>1100</td>
<td>7.00</td>
</tr>
<tr>
<td>3 Papers</td>
<td>161</td>
<td>1261</td>
<td>7.14</td>
</tr>
<tr>
<td>4 Papers</td>
<td>77</td>
<td>1338</td>
<td>7.20</td>
</tr>
<tr>
<td>5 Papers</td>
<td>68</td>
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<td>7.25</td>
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<td>6 Papers</td>
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</tr>
<tr>
<td>7 Papers</td>
<td>36</td>
<td>1475</td>
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<td>23</td>
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<tr>
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<td>22</td>
<td>1520</td>
<td>7.33</td>
</tr>
<tr>
<td>10 Papers</td>
<td>19</td>
<td>1539</td>
<td>7.34</td>
</tr>
<tr>
<td>11 Papers</td>
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<td>1548</td>
<td>7.34</td>
</tr>
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<td>1554</td>
<td>7.35</td>
</tr>
<tr>
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<td>7</td>
<td>1561</td>
<td>7.35</td>
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<tr>
<td>14 Papers</td>
<td>7</td>
<td>1568</td>
<td>7.36</td>
</tr>
<tr>
<td>15 Papers</td>
<td>10</td>
<td>1578</td>
<td>7.36</td>
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</tbody>
</table>
The present bibliograph on Drug Discovery in Herbal Plants also began as a rising curve and then continued in a horizontal straight line attesting Bradford's Bibliograph.
Table 28 Correlation Analysis of Journals and Publication count

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Journals</th>
<th>No of Articles</th>
</tr>
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<tr>
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<td>520</td>
</tr>
<tr>
<td>2004</td>
<td>346</td>
<td>617</td>
</tr>
<tr>
<td>2005</td>
<td>364</td>
<td>667</td>
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<tr>
<td>2006</td>
<td>354</td>
<td>670</td>
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<tr>
<td>2007</td>
<td>413</td>
<td>813</td>
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<tr>
<td>2008</td>
<td>480</td>
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<tr>
<td>2009</td>
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<tr>
<td>2010</td>
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<td>1161</td>
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</table>

From the year 2001 to 2010, there is an increase in the number of publications in the field of Drug Discovery in Medicinal Plants. Correspondingly there is an increase in the total number of journals contributing them. The correlation coefficient works out to 0.997 which is positive and neared to 1 showing a strong correlation.
4.8 Number of pages per research paper

Table 29 Number of Pages

<table>
<thead>
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<th>Pages</th>
<th>Count</th>
<th>Percent</th>
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</thead>
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<tr>
<td>3</td>
<td>256</td>
<td>3.50</td>
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<tr>
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<td>10</td>
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<tr>
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<tr>
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</table>

Research publications in Drug discovery in Medicinal Plants are published in various formats from single page editorial or reviews to multi
pages conference proceedings and journal articles. Single page editorials constitute 0.42 per cent. The journal articles with 6 pages form 12.32 per cent of the total output while articles with 5 pages form 10.17 per cent and articles with 7 pages form 11.96 per cent. This shows that the ideal number of pages in a journal article with respect to the subject Drug Discovery in Medicinal plants is 5 to 7 and more appropriately 6.
### 4.9 Referencing and Citing Pattern

#### Table 30 Number of References

<table>
<thead>
<tr>
<th>References</th>
<th>Count</th>
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<td>31-40 ref</td>
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</table>

Table 30 shows the number of references appended to the research articles in Drug Discovery in Medicinal Plants. The references ranges between a single reference to as many as more than 100 references. The journal articles with 21-30 references are more in number which forms nearly one fourth of the total research output. The second ranked category with respect to number of references is 31-40 and the third one is 11-20. Hence it can be understood that the ideal number of references in a research publication is 21-30 with respect to the subject Drug Discovery in Medicinal Plants.
Number of References

Pubs Count

References

1-10 ref
11-20 ref
21-30 ref
31-40 ref
41-50 ref
51-60 ref
61-70 ref
71-80 ref
81-90 ref
91-100 ref
100+ ref
No ref
Table 31  Number of Citations

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<tr>
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</table>
Citation is an acknowledgment one document receives from another. It is considered as the indication of scientific value of research writing. A citation usually includes the bibliographical details of document. The bibliographical details include particulars in various styles depending upon the type of documents covered. “Citation analysis is a new technique used to measure quantitatively the value of a document through arranging the citation of a document some kind of rank order”. It also used to study growth and structure of literature of any kind. Hence Citation analysis is yet another area research division in the field of Bibliometrics or Scientometrics. The number of citations appended to the articles vary from a single citation to 212 citations. More research papers in Drug Discovery in Medicinal plants have single or no citations. Research papers having one to two citations forms 25 per cent of the total output taken for study. From the table it can be understood that, the more the number of citations, the less the number of papers.
### 4.10 Country of Publication

#### Table 32 Country of Publication

<table>
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<th>Country</th>
<th>Count</th>
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</tr>
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Research output on Drug Discovery in Medicinal Plants are published in journals from various countries of the world, of which USA ranks first forming nearly one third of the total output. England ranks second with 22 per cent and this is followed by Netherlands with 8.07 per cent. Here it is interesting to note that USA and England collectively
publish more than 50 per cent of the total output in Drug Discovery in Medicinal Plants. Hence it can be understood that scholars in Drug Discovery in Medicinal Plants research prefer to publish their research findings in journals from USA and England despite their own mother country. India is in the 7th position while China is in the 9th Place.
Table 33 Preference of Publishing by Scholars from USA

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</tr>
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<td>1.51%</td>
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<tr>
<td>SWITZERLAND</td>
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<td>0.50%</td>
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<tr>
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<tr>
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<td>0.07%</td>
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<tr>
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</tr>
<tr>
<td>NIGER</td>
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<td>0.07%</td>
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<tr>
<td>SPAIN</td>
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<tr>
<td>CHILE</td>
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<td>TAIWAN</td>
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<td>ISRAEL</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

The scholars from USA publish their research findings in journals from various countries of the world. Majority of the research findings are published in journals from their own mother country (63.32%). England is preferred by 17.95 per cent of the scholars. The remaining one fourth is
published in journals from 28 countries. A negligible per cent of the papers (1.01%) are published in India.

**Table 34 Preference of Publishing by Scholars from Japan**

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
<th>Percent</th>
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</thead>
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</table>

The scholars from Japan publish their research findings in journals from various countries of the world. More than one fourth (26.98%) of the publications from Japan are in their own mother country. Majority of the research findings are published in journals from England (22.52%) and USA (28.47%). Here it is to be noted that nearly 50 per cent of the research productivity of Japanese scholars are published in England and USA. Hence it is evident that Japanese scholars prefer to publish their research findings in journals that are foreign to them. None of the papers by Japanese scholars are published in India.
Table 35  Preference of Publishing by Scholars from South Korea

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The scholars from South Korea publish their research findings in journals from various countries of the world. Nearly one fourth (22.27%) of the publications from South Korea are in their own mother country. Majority of the research findings are published in journals from England (17.73%) and USA (22.27%). Here it is to be noted that nearly 40 per cent of the research productivity of South Korean scholars are published in England and USA. Hence it is evident that Japanese scholars prefer to publish their research findings in journals that are foreign to them.
Scholars from Taiwan have published 175 papers in Drug discovery in Medicinal plants, of which, nearly 50 per cent are published from USA(26.86%) and England(24.57%). Only 7.43 per cent of the research papers are published from their own country. Also 1.73 per cent of the papers are published in China. None of the papers are published in India.

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</tr>
<tr>
<td>SPAIN</td>
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<td>0.39</td>
</tr>
<tr>
<td>AUSTRALIA</td>
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<td>0.26</td>
</tr>
<tr>
<td>GREECE</td>
<td>2</td>
<td>0.26</td>
</tr>
<tr>
<td>SERBIA</td>
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<td>0.13</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>TAIWAN</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>SLOVENIA</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>MEXICO</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>CZECH REPUBLIC</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>ITALY</td>
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<td>FINLAND</td>
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<td>0.13</td>
</tr>
<tr>
<td>SAUDI ARABIA</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>CROATIA</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>765</td>
<td>100.00</td>
</tr>
</tbody>
</table>
The scholars from India publish their research findings in journals from various countries of the world. Majority of the research findings are published in journals from their own mother country (22.35%). England is preferred by 18.56 per cent of the scholars and one fourth of the Indian publications are in journals from USA. The remaining 40 per cent of Indian research output is published in journals from 32 countries.
The scholars from Brazil publish their research findings in journals from various countries of the world. Majority of the research findings are published in journals from their own mother country (18.83%). England is preferred by 17.57 per cent of the scholars and 17.00 per cent of Brazilian publications are in journals from USA. The remaining 55 per cent of Indian research output is published in journals from 16 countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
<td>45</td>
<td>18.83%</td>
</tr>
<tr>
<td>USA</td>
<td>43</td>
<td>17.99%</td>
</tr>
<tr>
<td>ENGLAND</td>
<td>42</td>
<td>17.57%</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>36</td>
<td>15.06%</td>
</tr>
<tr>
<td>GERMANY</td>
<td>21</td>
<td>8.79%</td>
</tr>
<tr>
<td>IRELAND</td>
<td>18</td>
<td>7.53%</td>
</tr>
<tr>
<td>U ARAB EMIRATES</td>
<td>7</td>
<td>2.93%</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>7</td>
<td>2.93%</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>4</td>
<td>1.67%</td>
</tr>
<tr>
<td>FRANCE</td>
<td>4</td>
<td>1.67%</td>
</tr>
<tr>
<td>JAPAN</td>
<td>3</td>
<td>1.26%</td>
</tr>
<tr>
<td>CHILE</td>
<td>2</td>
<td>0.84%</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>POLAND</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>SCOTLAND</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>DENMARK</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>CANADA</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>SPAIN</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td>ITALY</td>
<td>1</td>
<td>0.42%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>239</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
Table 39 Preference of Publishing by Scholars from Germany

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>GERMANY</td>
<td>130</td>
<td>29.28</td>
</tr>
<tr>
<td>USA</td>
<td>117</td>
<td>26.35</td>
</tr>
<tr>
<td>ENGLAND</td>
<td>91</td>
<td>20.50</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>29</td>
<td>6.53</td>
</tr>
<tr>
<td>IRELAND</td>
<td>23</td>
<td>5.18</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>14</td>
<td>3.15</td>
</tr>
<tr>
<td>U ARAB EMIRATES</td>
<td>10</td>
<td>2.25</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td>6</td>
<td>1.35</td>
</tr>
<tr>
<td>DENMARK</td>
<td>4</td>
<td>0.90</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>4</td>
<td>0.90</td>
</tr>
<tr>
<td>FRANCE</td>
<td>4</td>
<td>0.90</td>
</tr>
<tr>
<td>MEXICO</td>
<td>3</td>
<td>0.68</td>
</tr>
<tr>
<td>SCOTLAND</td>
<td>2</td>
<td>0.45</td>
</tr>
<tr>
<td>NORWAY</td>
<td>2</td>
<td>0.45</td>
</tr>
<tr>
<td>GREECE</td>
<td>2</td>
<td>0.45</td>
</tr>
<tr>
<td>JAPAN</td>
<td>1</td>
<td>0.23</td>
</tr>
<tr>
<td>POLAND</td>
<td>1</td>
<td>0.23</td>
</tr>
<tr>
<td>ITALY</td>
<td>1</td>
<td>0.23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>444</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The scholars from Germany publish their research findings in journals from various countries of the world. Majority of the research findings are published in journals from their own mother country (29.28%). England is preferred by 20.50 per cent of the scholars and 26.35 per cent of Brazilian publications are in journals from USA. The remaining 25 per cent of German research output is published in journals from 15 countries.
Table 40 Preference of Publishing by Scholars from Australia

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLAND</td>
<td>35</td>
<td>30.43</td>
</tr>
<tr>
<td>USA</td>
<td>33</td>
<td>28.70</td>
</tr>
<tr>
<td>U ARAB EMIRATES</td>
<td>15</td>
<td>13.04</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>10</td>
<td>8.70</td>
</tr>
<tr>
<td>GERMANY</td>
<td>8</td>
<td>6.96</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>6</td>
<td>5.22</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>3</td>
<td>2.61</td>
</tr>
<tr>
<td>IRELAND</td>
<td>3</td>
<td>2.61</td>
</tr>
<tr>
<td>SCOTLAND</td>
<td>1</td>
<td>0.87</td>
</tr>
<tr>
<td>DENMARK</td>
<td>1</td>
<td>0.87</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>115</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The scholars from Australia publish their research findings in journals from various countries of the world. Only limited part of the research findings are published in journals from their own mother country (8.70%). England is preferred by 30.43 per cent of the scholars and 28.70 per cent of Australian publications are in journals from USA. The remaining 30 per cent of Australian research output is published in journals from 7 countries.
Table 41 Preference of Publishing by Scholars from England

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLAND</td>
<td>122</td>
<td>43.42%</td>
</tr>
<tr>
<td>USA</td>
<td>89</td>
<td>31.67%</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>15</td>
<td>5.34%</td>
</tr>
<tr>
<td>GERMANY</td>
<td>14</td>
<td>4.98%</td>
</tr>
<tr>
<td>IRELAND</td>
<td>9</td>
<td>3.20%</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td>8</td>
<td>2.85%</td>
</tr>
<tr>
<td>SCOTLAND</td>
<td>5</td>
<td>1.78%</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>4</td>
<td>1.42%</td>
</tr>
<tr>
<td>U ARAB EMIRATES</td>
<td>4</td>
<td>1.42%</td>
</tr>
<tr>
<td>DENMARK</td>
<td>2</td>
<td>0.71%</td>
</tr>
<tr>
<td>CANADA</td>
<td>2</td>
<td>0.71%</td>
</tr>
<tr>
<td>POLAND</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>SPAIN</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td>ITALY</td>
<td>1</td>
<td>0.36%</td>
</tr>
<tr>
<td></td>
<td>281</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

The scholars from England publish their research findings in journals from various countries of the world. Majority of the research findings are published in journals from their own mother country (43.42%). Netherlands is preferred by 5.34 per cent of the scholars and 31.67 per cent of English publications are in journals from USA. The remaining 20 per cent of Australian research output is published in journals from 15 countries.
Table 42 Subject wise Distribution

<table>
<thead>
<tr>
<th>Subject Areas</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHARMACOLOGY PHARMACY</td>
<td>3193</td>
<td>42.99</td>
</tr>
<tr>
<td>CHEMISTRY</td>
<td>1626</td>
<td>21.89</td>
</tr>
<tr>
<td>BIOCHEMISTRY MOLECULAR BIOLOGY</td>
<td>1056</td>
<td>14.22</td>
</tr>
<tr>
<td>PLANT SCIENCES</td>
<td>707</td>
<td>9.52</td>
</tr>
<tr>
<td>INTEGRATIVE COMPLEMENTARY MEDICINE</td>
<td>494</td>
<td>6.65</td>
</tr>
</tbody>
</table>

Table 42 shows the major subject areas of Drug delivery in Medicinal plants as identified by the ISI WebOfScience database. The leading subject area is Pharmacology pharmacy followed by Chemistry. The other areas are BIOCHEMISTRY MOLECULAR BIOLOGY(14.22%) and PLANT SCIENCES(9.52%)
4.11 Application of Lotka’s Law of Author Productivity

Table 43 Lotka’s Law of Author Productivity

<table>
<thead>
<tr>
<th>No of publications(X)</th>
<th>No of authors(Y)</th>
<th>X^nY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Publication</td>
<td>20678</td>
<td>20678</td>
</tr>
<tr>
<td>2 Publication</td>
<td>2848</td>
<td>20534.09</td>
</tr>
<tr>
<td>3 Publication</td>
<td>825</td>
<td>18890.76</td>
</tr>
<tr>
<td>4 Publication</td>
<td>368</td>
<td>19130.17</td>
</tr>
<tr>
<td>5 Publication</td>
<td>190</td>
<td>18655.98</td>
</tr>
<tr>
<td>6 Publication</td>
<td>115</td>
<td>18985.8</td>
</tr>
<tr>
<td>7 Publication</td>
<td>63</td>
<td>16138.75</td>
</tr>
<tr>
<td>8 Publication</td>
<td>40</td>
<td>14992.24</td>
</tr>
<tr>
<td>9 Publication</td>
<td>27</td>
<td>14156.47</td>
</tr>
<tr>
<td>10 Publication</td>
<td>18</td>
<td>12743.02</td>
</tr>
<tr>
<td>11 Publication</td>
<td>14</td>
<td>13004.61</td>
</tr>
<tr>
<td>12 Publication</td>
<td>9</td>
<td>10712.95</td>
</tr>
<tr>
<td>13 Publication</td>
<td>10</td>
<td>14953.35</td>
</tr>
<tr>
<td>14 Publication</td>
<td>6</td>
<td>11081.95</td>
</tr>
<tr>
<td>15 Publication</td>
<td>10</td>
<td>22483.3</td>
</tr>
</tbody>
</table>

In 1926, Alfred J. Lotka proposed his ‘Inverse Square Law’ correlating contributors of scientific papers to their number of contributions. His law provided fundamental theoretical base for bibliometric studies involving authorships. He was interested in determining "the part which men of different calibre contribute to the progress of science". For this, he checked the decennial index of 'Chemical Abstracts' 1907--1916 and counted the number of names against which appeared 1,2,3 ..... entries. He tabulated the data for 6,891 names beginning with the letter 'A' and 'B'. Similarly, the data from the Auerbach's Geschiefttafeln der physik was also collected for the 1325 physicists. Lotka then plotted the graph on a
logarithmic scale, the number of authors against the number of contributions made by each author and he found that in each case the points were closely scattered about a straight line, having a slope of approximately two to one. On the basis of those data, Lotka deduced a general equation, for the relation between the frequency 'y' of persons making 'x' contributions as follows:

\[ x^n y = \text{constant} \quad \text{and for the special case } n = 2. \]

In the present study, the values in the last column of Table 38 are not constant. Hence the present study do not confirm with Lotka’s law.

Table 44 Correlation between authors and publications

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Papers</th>
<th>No of authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>395</td>
<td>1521</td>
</tr>
<tr>
<td>2002</td>
<td>461</td>
<td>1612</td>
</tr>
<tr>
<td>2003</td>
<td>520</td>
<td>1897</td>
</tr>
<tr>
<td>2004</td>
<td>617</td>
<td>2509</td>
</tr>
<tr>
<td>2005</td>
<td>667</td>
<td>2551</td>
</tr>
<tr>
<td>2006</td>
<td>670</td>
<td>2804</td>
</tr>
<tr>
<td>2007</td>
<td>813</td>
<td>3425</td>
</tr>
<tr>
<td>2008</td>
<td>948</td>
<td>3907</td>
</tr>
<tr>
<td>2009</td>
<td>1072</td>
<td>4546</td>
</tr>
<tr>
<td>2010</td>
<td>1161</td>
<td>5058</td>
</tr>
<tr>
<td></td>
<td>7324</td>
<td></td>
</tr>
</tbody>
</table>

There is growth in the publication productivity in the subject Drug discovery in Medicinal plants during the 10 year period from 2001 to 2010. Corresponding to this growth there is also increase in the number of
authors contributing them. The correlation coefficient of number of authors and number of publications works out to 0.997 which is positive and nearer to 1 showing a positive and strong correlation. That is, as the number of publications increases, the number of contributing authors also will increase.

**Table 45 Per capita Authorship**

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
<th>No of authors</th>
<th>Per capita Authorship</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>395</td>
<td>1521</td>
<td>0.26</td>
</tr>
<tr>
<td>2002</td>
<td>461</td>
<td>1612</td>
<td>0.29</td>
</tr>
<tr>
<td>2003</td>
<td>520</td>
<td>1897</td>
<td>0.27</td>
</tr>
<tr>
<td>2004</td>
<td>617</td>
<td>2509</td>
<td>0.25</td>
</tr>
<tr>
<td>2005</td>
<td>667</td>
<td>2551</td>
<td>0.26</td>
</tr>
<tr>
<td>2006</td>
<td>670</td>
<td>2804</td>
<td>0.24</td>
</tr>
<tr>
<td>2007</td>
<td>813</td>
<td>3425</td>
<td>0.24</td>
</tr>
<tr>
<td>2008</td>
<td>948</td>
<td>3907</td>
<td>0.24</td>
</tr>
<tr>
<td>2009</td>
<td>1072</td>
<td>4546</td>
<td>0.24</td>
</tr>
<tr>
<td>2010</td>
<td>1161</td>
<td>5058</td>
<td>0.23</td>
</tr>
</tbody>
</table>

The per capita authorship is the number of authors per publication. The per capita authorship ranges from 0.23 to 0.29. The per capita authorship is maximum in the year 2002 and minimum in the year 2010. From the table 23 it is seen that the per capita authorship falls in the year 2010. This is an evidence that collaborative authorship is the trend of the day and the number of collaborators in a publication has increased from four in the year 2001 to five in the year 2010.
### 4.12 Most Prolific Authors

Table 46 Ranked list of authors

<table>
<thead>
<tr>
<th>Author Name</th>
<th>Total Count</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supuran, CT</td>
<td>60</td>
<td>1</td>
</tr>
<tr>
<td>Scozzafava, A</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>Ernst, E</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>Zhou, SF</td>
<td>37</td>
<td>4</td>
</tr>
<tr>
<td>Kumar, A</td>
<td>34</td>
<td>5</td>
</tr>
<tr>
<td>Evstigneev, MP</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>Davies, DB</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>Saller, R</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Boykin, DW</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>Chen, X</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Bilia, AR</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Vincieri, FF</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Brun, R</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>Vullo, D</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Maurer, HH</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Liu, L</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Li, Y</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Patwardhan, B</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Tsai, TH</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Wang, L</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Zhang, L</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>Ahmad, M</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>Chen, J</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Kumar, S</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Li, J</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Innocenti, A</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>Kim, JH</td>
<td>15</td>
<td>27</td>
</tr>
</tbody>
</table>

Table 46 shows the list of most prolific authors ranked according to the publication count. Supuran, CT from Italy ranks first contributing 60 publications and this is followed by Scozzafava, A from Italy. The third ranked author is Ernst, E from England. Here it is to be noted that the first
two ranked authors are from Italy, though the maximum contributions are from USA.

**Table 47  Ranked authors in Solo Research**

<table>
<thead>
<tr>
<th>Author Name</th>
<th>Total Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst, E</td>
<td>14</td>
</tr>
<tr>
<td>Cheng, TO</td>
<td>9</td>
</tr>
<tr>
<td>Teschke, R</td>
<td>5</td>
</tr>
<tr>
<td>Williamson, EM</td>
<td>3</td>
</tr>
<tr>
<td>Dasgupta, A</td>
<td>3</td>
</tr>
<tr>
<td>Phillipson, JD</td>
<td>3</td>
</tr>
<tr>
<td>Wheatley, D</td>
<td>3</td>
</tr>
<tr>
<td>Bressler, R</td>
<td>3</td>
</tr>
<tr>
<td>Habtemariam, S</td>
<td>3</td>
</tr>
<tr>
<td>Abubakar, EMM</td>
<td>3</td>
</tr>
<tr>
<td>Chan, TYK</td>
<td>3</td>
</tr>
</tbody>
</table>

The total number of authors in Drug discovery in Medicinal Plants who were engaged in solo research is 460. Ernst, E ranks first and has contributed 42 contributions on the whole of which 14 papers are the result of solo research. The second ranked author in solo research is Cheng, TO from China and the third author is Teschke R from Japan.
### Table 48 Ranked authors According to their weighted share

<table>
<thead>
<tr>
<th>Author</th>
<th>Count</th>
<th>Share</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst, E</td>
<td>42</td>
<td>24.65</td>
<td>2</td>
</tr>
<tr>
<td>Supuran, CT</td>
<td>60</td>
<td>14.32</td>
<td>1</td>
</tr>
<tr>
<td>Zhou, SF</td>
<td>37</td>
<td>9.33</td>
<td>4</td>
</tr>
<tr>
<td>Scozzafava, A</td>
<td>42</td>
<td>8.77</td>
<td>3</td>
</tr>
<tr>
<td>Teschke, R</td>
<td>12</td>
<td>7.28</td>
<td>44</td>
</tr>
<tr>
<td>Saller, R</td>
<td>23</td>
<td>7.28</td>
<td>8</td>
</tr>
<tr>
<td>Kumar, A</td>
<td>34</td>
<td>6.81</td>
<td>5</td>
</tr>
<tr>
<td>Evstigneev, MP</td>
<td>26</td>
<td>6.43</td>
<td>6</td>
</tr>
<tr>
<td>Davies, DB</td>
<td>26</td>
<td>6.40</td>
<td>7</td>
</tr>
<tr>
<td>Dasgupta, A</td>
<td>12</td>
<td>6.28</td>
<td>45</td>
</tr>
<tr>
<td>Bilia, AR</td>
<td>20</td>
<td>6.03</td>
<td>10</td>
</tr>
<tr>
<td>Izzo, AA</td>
<td>13</td>
<td>5.63</td>
<td>34</td>
</tr>
<tr>
<td>Patwardhan, B</td>
<td>15</td>
<td>5.58</td>
<td>18</td>
</tr>
<tr>
<td>Maurer, HH</td>
<td>17</td>
<td>5.18</td>
<td>14</td>
</tr>
<tr>
<td>Tsai, TH</td>
<td>15</td>
<td>4.95</td>
<td>19</td>
</tr>
<tr>
<td>Wagner, H</td>
<td>10</td>
<td>4.71</td>
<td>67</td>
</tr>
<tr>
<td>Morris, ME</td>
<td>12</td>
<td>4.67</td>
<td>46</td>
</tr>
<tr>
<td>Guengerich, FP</td>
<td>10</td>
<td>4.59</td>
<td>68</td>
</tr>
<tr>
<td>Vincieri, FF</td>
<td>19</td>
<td>4.20</td>
<td>12</td>
</tr>
<tr>
<td>Jagetia, GC</td>
<td>10</td>
<td>4.20</td>
<td>69</td>
</tr>
<tr>
<td>Baliga, MS</td>
<td>9</td>
<td>4.20</td>
<td>85</td>
</tr>
<tr>
<td>Kumar, S</td>
<td>15</td>
<td>3.95</td>
<td>20</td>
</tr>
<tr>
<td>Nilsen, OG</td>
<td>10</td>
<td>3.92</td>
<td>70</td>
</tr>
<tr>
<td>Wang, Y</td>
<td>13</td>
<td>3.67</td>
<td>35</td>
</tr>
<tr>
<td>Lee, HK</td>
<td>11</td>
<td>3.63</td>
<td>53</td>
</tr>
</tbody>
</table>

In a collaborative publication, the responsibility is presumed to be shared equally by the collaborating authors. Hence each author is given a weight according to their share. For example in a publication by five authors, the share of each author is 0.20. Table 41 shows the ranked list of authors according to their weighted share. Supuran, CT who have contributed the maximum of 60 publications is moved to the second
position Scozzafava, A is moved from the third position to the fourth place. Similarly Ernst A who ranked second according to the total contributions is moved to the first position. Teschke, R who was in the 44th place with only 12 contributions is now moved to the fifth place.
Table 49 Ranked authors according to Potency

<table>
<thead>
<tr>
<th>Author</th>
<th>Count</th>
<th>Potency</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst, E</td>
<td>42</td>
<td>21.27</td>
<td>3</td>
</tr>
<tr>
<td>Zhou, SF</td>
<td>37</td>
<td>9.72</td>
<td>4</td>
</tr>
<tr>
<td>Teschke, R</td>
<td>12</td>
<td>8.35</td>
<td>45</td>
</tr>
<tr>
<td>Scozzafava, A</td>
<td>42</td>
<td>8.35</td>
<td>2</td>
</tr>
<tr>
<td>Supuran, CT</td>
<td>60</td>
<td>8.08</td>
<td>1</td>
</tr>
<tr>
<td>Dasgupta, A</td>
<td>12</td>
<td>7.10</td>
<td>49</td>
</tr>
<tr>
<td>Bilia, AR</td>
<td>20</td>
<td>6.84</td>
<td>11</td>
</tr>
<tr>
<td>Evstigneev, MP</td>
<td>26</td>
<td>6.81</td>
<td>6</td>
</tr>
<tr>
<td>Kumar, A</td>
<td>34</td>
<td>6.73</td>
<td>5</td>
</tr>
<tr>
<td>Saller, R</td>
<td>23</td>
<td>6.66</td>
<td>8</td>
</tr>
<tr>
<td>Jagetia, GC</td>
<td>10</td>
<td>5.80</td>
<td>80</td>
</tr>
<tr>
<td>Izzo, AA</td>
<td>13</td>
<td>5.78</td>
<td>43</td>
</tr>
<tr>
<td>Patwardhan, B</td>
<td>15</td>
<td>5.23</td>
<td>18</td>
</tr>
<tr>
<td>Davies, DB</td>
<td>26</td>
<td>4.63</td>
<td>7</td>
</tr>
<tr>
<td>Wang, Y</td>
<td>13</td>
<td>4.08</td>
<td>35</td>
</tr>
<tr>
<td>Wagner, H</td>
<td>10</td>
<td>4.02</td>
<td>69</td>
</tr>
<tr>
<td>Borrelli, F</td>
<td>11</td>
<td>3.97</td>
<td>55</td>
</tr>
<tr>
<td>Tsai, TH</td>
<td>15</td>
<td>3.60</td>
<td>19</td>
</tr>
<tr>
<td>Reichling, J</td>
<td>14</td>
<td>3.60</td>
<td>28</td>
</tr>
<tr>
<td>Melzer, J</td>
<td>11</td>
<td>3.52</td>
<td>63</td>
</tr>
<tr>
<td>Chen, J</td>
<td>15</td>
<td>3.51</td>
<td>23</td>
</tr>
<tr>
<td>Guengerich, FP</td>
<td>10</td>
<td>3.45</td>
<td>82</td>
</tr>
<tr>
<td>Baliga, MS</td>
<td>9</td>
<td>3.43</td>
<td>97</td>
</tr>
<tr>
<td>Morris, ME</td>
<td>12</td>
<td>3.37</td>
<td>52</td>
</tr>
<tr>
<td>Wang, Q</td>
<td>14</td>
<td>3.35</td>
<td>30</td>
</tr>
</tbody>
</table>

According to the Dr. S. R. Ranganathan’s canon of Prepotence by, the potency (power or strength) to decide the position of an entry among the various entries in a catalogue should, if possible, be concentrated totally in the leading section. Within the leading section, as far as possible, it should be concentrated in the entry element. In total concentration in the leading section is not possible, the minimum possible potency should be allowed to overflow beyond it to later sections; and even this spillover
should be distributed in the later sections in a decreasing sequence of intensity. Applying this canon to the position of authors in the list of authors for a specific publication, weightage can be given to the authors according to their position. If there are n authors for a publication, the weightage (w) of an author in pth position (p < n) for that publication can be calculated as

\[ W = \frac{(n - p + 1)}{n!} \text{ where } \sum_{1}^{n} W = 1 \]

For example, in a publication by 5 authors, the weightage for authors in various (five) positions can be calculated as

1\textsuperscript{st} Position = \frac{(5 - 1 + 1)}{5!} = 5/15

2\textsuperscript{nd} position = \frac{(5 - 2 + 1)}{5!} = 4/15

3\textsuperscript{rd} position = \frac{(5 - 3 + 1)}{5!} = 3/15

4\textsuperscript{th} position = \frac{(5 - 4 + 1)}{5!} = 2/15

5\textsuperscript{th} position = \frac{(5 - 5 + 1)}{5!} = 1/15

An application of this principle to the ranked list of authors, the entire ranking gets changed.
4.12 Referencing Pattern

Table 50 Year wise Distribution of References

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>830</td>
</tr>
<tr>
<td>2009</td>
<td>4785</td>
</tr>
<tr>
<td>2008</td>
<td>9333</td>
</tr>
<tr>
<td>2007</td>
<td>12869</td>
</tr>
<tr>
<td>2006</td>
<td>15929</td>
</tr>
<tr>
<td>2005</td>
<td>18238</td>
</tr>
<tr>
<td>2004</td>
<td>19956</td>
</tr>
<tr>
<td>2003</td>
<td>21529</td>
</tr>
<tr>
<td>2002</td>
<td>22952</td>
</tr>
<tr>
<td>2001</td>
<td>22366</td>
</tr>
<tr>
<td>2000</td>
<td>24462</td>
</tr>
<tr>
<td>1990-1999</td>
<td>117870</td>
</tr>
<tr>
<td>1980-1989</td>
<td>23475</td>
</tr>
<tr>
<td>1970-1979</td>
<td>12122</td>
</tr>
<tr>
<td>1960-1969</td>
<td>4570</td>
</tr>
<tr>
<td>1950-1959</td>
<td>2096</td>
</tr>
<tr>
<td>1901-1950</td>
<td>1779</td>
</tr>
<tr>
<td>1851-1900</td>
<td>224</td>
</tr>
<tr>
<td>1800-1850</td>
<td>36</td>
</tr>
<tr>
<td>Before 1800</td>
<td>80</td>
</tr>
</tbody>
</table>

On the whole there are 344828 references appended to the research articles in Drug Discovery in Herbal Medicine. These references belong to various years/time periods ranging from before 1800 to the year 2010. Among the references, nearly fifty per cent belong to the period prior to the new millennium. References to articles in 2000 is maximum.
Table 51  Most referred authors

<table>
<thead>
<tr>
<th>Author</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst E</td>
<td>874</td>
</tr>
<tr>
<td>*WHO</td>
<td>804</td>
</tr>
<tr>
<td>EISENBERG DM</td>
<td>479</td>
</tr>
<tr>
<td>SUPURAN CT</td>
<td>454</td>
</tr>
<tr>
<td>Guengerich FP</td>
<td>426</td>
</tr>
<tr>
<td>Zhou SF</td>
<td>277</td>
</tr>
<tr>
<td>Fugh-Berman A</td>
<td>244</td>
</tr>
<tr>
<td>Piscitelli SC</td>
<td>233</td>
</tr>
<tr>
<td>Scozzafava A</td>
<td>229</td>
</tr>
<tr>
<td>Izzo AA</td>
<td>229</td>
</tr>
<tr>
<td>Gurley BJ</td>
<td>222</td>
</tr>
<tr>
<td>BLUMENTHAL M</td>
<td>193</td>
</tr>
<tr>
<td>SHIMADA T</td>
<td>189</td>
</tr>
<tr>
<td>Nebert DW</td>
<td>187</td>
</tr>
<tr>
<td>WAGNER H</td>
<td>180</td>
</tr>
<tr>
<td>BARNES J</td>
<td>166</td>
</tr>
<tr>
<td>Markowitz JS</td>
<td>164</td>
</tr>
<tr>
<td>LINDE K</td>
<td>157</td>
</tr>
<tr>
<td>MILLER LG</td>
<td>154</td>
</tr>
<tr>
<td>Johne A</td>
<td>153</td>
</tr>
<tr>
<td>LOWRY OH</td>
<td>146</td>
</tr>
<tr>
<td>Moore LB</td>
<td>142</td>
</tr>
<tr>
<td>PITTLER MH</td>
<td>138</td>
</tr>
<tr>
<td>Cheng TO</td>
<td>138</td>
</tr>
<tr>
<td>Davies DB</td>
<td>136</td>
</tr>
</tbody>
</table>

There are 137478 authors referred by the research articles in the subject Drug Discovery in Medicinal Plants. The most referred author is Ernst E who is the third among the ranked list of authors. SUPURAN CT ranks third in the list of referred authors and he is the first prolific author in the subject.
Table 52 Core Journals Referred

<table>
<thead>
<tr>
<th>Journal</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>J ETHNOPHARMACOL</td>
<td>6819</td>
</tr>
<tr>
<td>J BIOL CHEM</td>
<td>6390</td>
</tr>
<tr>
<td>J MED CHEM</td>
<td>4985</td>
</tr>
<tr>
<td>J AM CHEM SOC</td>
<td>4306</td>
</tr>
<tr>
<td>P NATL ACAD SCI USA</td>
<td>3956</td>
</tr>
<tr>
<td>PLANTA MED</td>
<td>3675</td>
</tr>
<tr>
<td>DRUG METAB DISPOS</td>
<td>3523</td>
</tr>
<tr>
<td>BIOCHEMISTRY-US</td>
<td>3110</td>
</tr>
<tr>
<td>CANCER RES</td>
<td>3043</td>
</tr>
<tr>
<td>BIOCHEM PHARMACOL</td>
<td>2895</td>
</tr>
<tr>
<td>PHYTOCHEMISTRY</td>
<td>2656</td>
</tr>
<tr>
<td>SCIENCE</td>
<td>2633</td>
</tr>
<tr>
<td>LANCET</td>
<td>2603</td>
</tr>
<tr>
<td>CLIN PHARMACOL THER</td>
<td>2431</td>
</tr>
<tr>
<td>NATURE</td>
<td>2387</td>
</tr>
<tr>
<td>J CHROMATOGR A</td>
<td>2362</td>
</tr>
<tr>
<td>J PHARMACOL EXP THER</td>
<td>2343</td>
</tr>
<tr>
<td>PHYTOTHER RES</td>
<td>2215</td>
</tr>
<tr>
<td>JAMA-J AM MED ASSOC</td>
<td>2186</td>
</tr>
<tr>
<td>NEW ENGL J MED</td>
<td>2135</td>
</tr>
<tr>
<td>BIOORG MED CHEM LETT</td>
<td>2031</td>
</tr>
<tr>
<td>MOL PHARMACOL</td>
<td>1944</td>
</tr>
<tr>
<td>BIOCHEM BIOPH RES CO</td>
<td>1831</td>
</tr>
<tr>
<td>CARCINOGENESIS</td>
<td>1797</td>
</tr>
<tr>
<td>LIFE SCI</td>
<td>1772</td>
</tr>
</tbody>
</table>

The referred journals by scholars in Drug Discovery in Medicinal Plants research are 24301. Table 52 shows the core journals referred. Journal of ethnopharmacology from Italy is the highly ranked journal and this is followed by Journal of Biological chemistry and Journal of Medicinal Chemistry. From the list of referred journals it can be understood that the referred journals list resembles the core journal list.
Table 53  Application of Bradford’s law to Referred Journals

<table>
<thead>
<tr>
<th>Zones</th>
<th>Number of Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>57</td>
</tr>
<tr>
<td>Zone 2</td>
<td>365</td>
</tr>
<tr>
<td>Zone 3</td>
<td>23879</td>
</tr>
</tbody>
</table>

The total journals referred are divided into three zones each containing equal number of articles and Bradford’s law is applied. The three zones are in the ratio 57:365:23879:: 1:6.40:418.9 which is not in the form 1:n:n² and hence the analysis of the referred journals do not corroborate with Bradford’s law.
Table 54 Application of Lotka’s law to Referred authors

<table>
<thead>
<tr>
<th>No of Papers</th>
<th>No of Papers</th>
<th>$X^n y = K$ (n = 2.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30973</td>
<td>30973</td>
</tr>
<tr>
<td>2</td>
<td>6686</td>
<td>37822</td>
</tr>
<tr>
<td>3</td>
<td>2496</td>
<td>38909</td>
</tr>
<tr>
<td>4</td>
<td>1263</td>
<td>40416</td>
</tr>
<tr>
<td>5</td>
<td>711</td>
<td>39746</td>
</tr>
<tr>
<td>6</td>
<td>470</td>
<td>41445</td>
</tr>
<tr>
<td>7</td>
<td>285</td>
<td>36948</td>
</tr>
<tr>
<td>8</td>
<td>227</td>
<td>41091</td>
</tr>
<tr>
<td>9</td>
<td>180</td>
<td>43740</td>
</tr>
<tr>
<td>10</td>
<td>121</td>
<td>38264</td>
</tr>
<tr>
<td>11</td>
<td>98</td>
<td>39329</td>
</tr>
<tr>
<td>12</td>
<td>75</td>
<td>37412</td>
</tr>
<tr>
<td>13</td>
<td>54</td>
<td>32904</td>
</tr>
<tr>
<td>14</td>
<td>50</td>
<td>36668</td>
</tr>
<tr>
<td>15</td>
<td>41</td>
<td>35728</td>
</tr>
<tr>
<td>16</td>
<td>42</td>
<td>43008</td>
</tr>
<tr>
<td>17</td>
<td>26</td>
<td>30981</td>
</tr>
</tbody>
</table>

Lotka’s law is applied to the referred authors and presented in Table 54. The values in the last column are nearly constant for $n = 2.8$ proving Lotka’s law.
4.13 **PRICE’S**\textsuperscript{105} **FUNDAMENTAL LAW OF SCIENCE**

Price’s celebrated lectures on “Little Science and Big Science” reviewed some earlier works by Francis Galton, J.M. Cattell and A.J. Lotka and presented a notable “feeling that most of the great scientists are still with us, and that the greater part of scientific work has been produced within living memory, within the span of the present generation of scientists”. But once the mathematical nature of the model he considered is understood, the awe, if any, disappears. He considers an exponential time trend as the appropriate model to fit for data on number of scientists. He calls this principle of exponential growth as the “fundamental law of any analysis of science”.

Let \( y_t \) be number of scientists during a period \( t \). (\( t \) may be just 1 year or a span of say, 30 or 45, years).

\[
y_t = e^{a' + b't} \quad \text{------------------------------------------1}
\]

\[
\log y_t = a' + b't
\]

Let \( a' = \log a \) and \( b' = \log b \). Then \( \log y_t = \log a + t \log b \)

Or \( y_t = a^* b^t \quad \text{------------------------------------------2} \)

In (2) if \( b > 1 \) the exponential curve is rising over time (+ve growth) and if \( b < 1 \), curve is falling down (-ve growth). (2) may also be written as

\[
y_t = y_0 \times b^t \quad \text{(Since} \quad t=0, \quad y_0 = a= \text{number of scientists in the beginning)}.
\]

or \( y_t = y_{t-1} \times b \)

Since \( b > 1 \), obviously the number of scientists during any period \( t \) is greater than those existing during any particular period in the past.

**Table 55 Price's Fundamental Law Of Science**

<table>
<thead>
<tr>
<th>Year</th>
<th>Time</th>
<th>No of authors</th>
<th>Exponential Growth ( b = y_{t1}/y_{t0} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0</td>
<td>1521</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>1</td>
<td>1612</td>
<td>1.06</td>
</tr>
<tr>
<td>2003</td>
<td>2</td>
<td>1897</td>
<td>1.18</td>
</tr>
<tr>
<td>2004</td>
<td>3</td>
<td>2509</td>
<td>1.32</td>
</tr>
<tr>
<td>2005</td>
<td>4</td>
<td>2551</td>
<td>1.02</td>
</tr>
<tr>
<td>2006</td>
<td>5</td>
<td>2804</td>
<td>1.10</td>
</tr>
<tr>
<td>2007</td>
<td>6</td>
<td>3425</td>
<td>1.22</td>
</tr>
<tr>
<td>2008</td>
<td>7</td>
<td>3907</td>
<td>1.14</td>
</tr>
<tr>
<td>2009</td>
<td>8</td>
<td>4546</td>
<td>1.16</td>
</tr>
<tr>
<td>2010</td>
<td>9</td>
<td>5058</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Table 55 shows the exponential growth of authors / scientists from 2001 to 2009. The formula \( y_t = e^{a+bt} \) is applied. From the table it is seen that the value of \( b \) is greater than 1 in all the years proving Price's fundamental law of science. Hence Price's exponential growth which is known as the "Fundamental of any analysis of science" is proved to be true in case of the science subject namely Drug Discovery in Medicinal Plants.
4.14 PRICE'S 80-20 RULE

It is observed in library and information field that:

- Most of the documents are hardly circulated/used/cited and very few books are frequently circulated/used/cited.
- Most of the authors publish very few articles and very few authors publish more frequently.

This phenomenon is explained fairly by a 80-20 rule. That is 80% of the documents contribute to 20% of the total circulations/citations received. 20% of the documents contribute to 80% of the total circulations/citations received. The 20% of such documents are called "core documents/core collection". Similarly it is observed that 20% of the given authors (at any given time are called "Core authors") contribute to 80% of the total literature output. Here in the present study, out of the 1670 journals contributing a total of 7324 publications, 349 journals (i.e 20 per cent of the total journals) contribute 5134 publications which is more than 80 per cent of the total output. Hence it is observed that the present study do not confine with that of the 80-20 rule.

Economic Growth and Literature Output

The overall economic growth of a country can be measured in terms of its Gross National product (GNP) or Gross Domestic Product
(GDP). “Gross Domestic Product (GDP) is the market value of all goods and services produced in a year within the country’s border. It is the standard measure of the overall size of the economy. The growth in real GDP that is GDP after inflation taken into account is often used as an indicator of the general health of the economy. When real GDP is growing near its long-term potential growth rate – a rate which, in turn, is stock and the pace of technological change- then the economy is generally in good shape. A negative rate of change in GDP is typically bad news”\textsuperscript{106}. When an economy produces less than it did in the previous year, it usually means higher unemployment and a lower than it did in the previous year, it usually means higher unemployment and a lower standard of living for the population.

GDP is a limited measure insofar as it does not take certain activities into account that are “outside the market” and those certain activities include the value of work done within the home or by volunteer workers, or the harmful effects on human health from air and water pollution. Here in the present study the research on finding drugs with natural resources may have effect on the economy of the country. Hence The GDP of selective countries has been taken into account to find out whether the economy of a country has an effect on its Biomedical literature output.

\textsuperscript{106} www.cftech.com/brainbank/finance/gdp.html
Table 56 GDP of countries and Research output

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazil</th>
<th></th>
<th>India</th>
<th></th>
<th>China</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDP $ per capita</td>
<td>Pubs</td>
<td>GDP $ per capita</td>
<td>Pubs</td>
<td>GDP $ per capita</td>
<td>Pubs</td>
</tr>
<tr>
<td>2001</td>
<td>3,131.30</td>
<td>5</td>
<td>463.25</td>
<td>18</td>
<td>1,041.64</td>
<td>8</td>
</tr>
<tr>
<td>2002</td>
<td>2,827.94</td>
<td>6</td>
<td>484.36</td>
<td>24</td>
<td>1,135.45</td>
<td>29</td>
</tr>
<tr>
<td>2003</td>
<td>3,045.45</td>
<td>11</td>
<td>565.41</td>
<td>28</td>
<td>1,273.64</td>
<td>13</td>
</tr>
<tr>
<td>2004</td>
<td>3,609.11</td>
<td>13</td>
<td>644.48</td>
<td>52</td>
<td>1,490.34</td>
<td>40</td>
</tr>
<tr>
<td>2005</td>
<td>4,734.18</td>
<td>22</td>
<td>736.11</td>
<td>55</td>
<td>1,720.09</td>
<td>38</td>
</tr>
<tr>
<td>2006</td>
<td>5,659.74</td>
<td>21</td>
<td>816.6</td>
<td>55</td>
<td>2,033.90</td>
<td>57</td>
</tr>
<tr>
<td>Correl.coeff</td>
<td>0.91</td>
<td></td>
<td>0.93</td>
<td></td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

Table 56 shows the Drug Discovery in Medicinal Plants research literature output from the select leading countries and their Gross Domestic Product index. It is noticed that among the all the counties show positive correlation. India has the strongest correlation and China has the least correlation. This shows that as the GDP grows, there is growth in research output.