

## The communicability of the journal *Acta botanica croatica* over the 1991–2000 period

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The papers published in the journal *Acta botanica croatica* in the period from 1991 to 2000 are analysed from a scientometric point of view. The purpose of this article is to determine the communicability of this journal through parameters such as the extent to which institutions and countries are represented in the authors of the papers, the number of citations per year measured in the SCI (Web of Science), the age of the literature quoted in terms of years, the distribution of and list of journals that cite *Acta botanica croatica*, and the geographical origin of the journals that cite it. *Acta botanica croatica* is read and available in 24 countries, it has been cited by 101 journals covered in the SCI; since 1998 original scientific papers have been written in English, and the potential accessibility of the journal has been increased. In 2000 the percentage of foreign authors publishing in the journal rose to 57%.

**Key words:** communicability, scientometrics

### Introduction

A journal is by definition the basic conventional medium of communication among scientists, in the exchange of ideas, knowledge and results. Cooperation among scientists is most frequently an expression of the individual interests and motivations of individuals (GLÄNZEL 2000). Forms of cooperation are measurable, apart from through classic forms of cooperation between two or more institutions and the joint publication of papers, through citations or references of scientists to the results of colleagues who deal with cognate problem areas. One of the indicators of the importance and significance of some journal is the proportion of non-domestic authors of papers. The potential accessibility of the papers from the journal to the general scientific community is visible from the extent to which the papers from the journal are represented in the relevant secondary sources. These indicators can provide an image of and indicate the status of the communicability of some journal, that is, they give a picture of the position and role of this journal in the more restricted or

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more general scientific community. In the literature the concept of the »visibility« of some journal is often encountered ((LUUKKONEN 1992), alternately of its »international diffusion« (KORTELAINEN 2001), which is methodologically a concept similar to communicability.

The journal *Acta botanica croatica* (ABC) has come out more or less continuously under the same title since 1957, although its origins can be traced back to 1925. The journal was not issued during the 1937–1948 period or in the period from 1950 to 1955, and from the time of its founding it has changed its title three times (ILIJANIĆ 1992). In its sub-title, the journal is defined as an international journal for botany. The editorial board is made up, in addition to Croatian scientists, of colleagues from Italy, Hungary, Austria and the Czech Republic. Since 1998 all the articles have been published in English, which has potentially increased the international accessibility of the journal. The most relevant secondary sources of information, electronic databases – Biological Abstracts, CAB Abstracts, Chemical Abstracts, Aquatic Science & Fisheries Abstracts, Agricola, Toxline selectively to a greater or less extent deal bibliographically with the contents of *Acta botanica Croatica*. The ISI (Institute for Scientific Information, Philadelphia, USA) databases, Science Citation Index (SCI) and the new version of WoS (Web of Science), which covers all three citation indices, as well as Current Contents (CC) do not deal with the contents of our journal. The reasons are various, but certainly among the most important are the dynamics with which the journal is published, the kind of research that is in the trends, the extent to which the area is covered in these databases ((THE ISI DATABASE, 2001) and of course their more stringent selection criteria. Apart from this, Croatia is represented in the ISI bases, all the three citation indices (SCI, SSCI (Social Science Citation Index) and Arts & Humanities Citation Index) as well as Current Contents by 12 journals: *Croatica chemica acta*, *Chemical and Biochemical Engineering Quarterly*, *Croatian medical journal*, *Neurologia croatica*, *Periodicum biologorum*, *Strojarstvo*, *Tekstil*, *Food Technology and Biotechnology*, *Metalurgija*, *Collegium antropologicum*, *Društvena istraživanja* and , so there are relatively slight chances that a journal of the profile of *Acta botanica croatica* will in the very near future be represented in the core of world science. That is, the ISI databases, WoS and CC deal with only 5–7% of all today's scientific production (JOKIĆ 1998).

In this investigation we have decided on an analysis of the communicability of the journal *Acta botanica croatica* during the period of the last decade of the twentieth century, because this is connected with certain social and economic events and the country's achievement of independence; in addition, the journal has gone through certain changes in concept that we wished to record through scientific methods.

## Methodology

The communicability of a journal can be defined through several indicators, among which is the degree to which authors beyond the borders of the country in which the journal is published contribute, the language or languages in which the papers are published, an analysis of the degree to which papers from the journal are cited, an analysis of the journals that cite this journal, the geographical representation of the journal and so on.

In this paper we have measured the communicability of the journal in the period from 1991 to 2000, through: the representation of the institutions or the countries of the authors of papers, the number of citations per year measured in the SCI, part of the WoS database,

the age of the literature cited per year, the distribution and the list of journals that cite *Acta botanica croatica* (ABC) and the geographical origin of journals that cite it. Only original scientific papers are included in the analysis.

## Results and discussion

In the introduction it was mentioned that since 1998, works in ABC are written only in English. This has expanded its potential accessibility to cover the whole of the scientific community. It is important to mention that the journal had papers in English earlier as well, but also in German, French and Croatian. Although the title indicates that it covers the general area of botany, which in a certain way limits its specificity, the editorial board stresses that ABC includes papers from the research areas of plants and algae, and land and aqueous ecosystems at all levels, as well as plant viruses and bacteria. A certain emphasis is also placed on geographical characteristics, on southern Europe and the Adriatic Sea or the Mediterranean. In the geographical characteristics of its scientific investigations, in this case, botanical research that is related to the specific features of areas and ecosystems, the journal can have a very important role, for example, by concentrating cognate research works in a single publication. On the other hand this can have certain negative connotations in conventional systems for evaluating scientific activities, for example, in the degree to which it is represented and cited in the ISI databases mentioned.

### The degree to which institutes or countries are represented by the authors of papers

As can be seen from the very name of the journal, it is to be expected that most of the works will come from Croatia, or that that the problem areas are likely to be connected to this geographical area. Of course, this statement refers primarily to botanical research, and less to virological and microbiological investigations. There were 144 papers in all in the period analysed, 77.8% of them coming from Croatia. Table 1 shows the degree to which institutions in Croatia are represented in the period from 1991 to 2000.

**Tab. 1.** Degree to which the institutions of the authors from Croatia are represented

| Institution of authors                       | Number of papers | City         |
|--|------------------|--------------|
| Faculty of Science, Division of Biology      | 61               | Zagreb       |
| Faculty of Forestry                          | 18               | Zagreb       |
| Ruđer Bošković Institute                     | 11               | Zagreb       |
| Faculty of Education                         | 6                | Osijek       |
| Faculty of Natural Science and Education     | 4                | Split        |
| Faculty of Agriculture                       | 2                | Zagreb       |
| Faculty of Pharmacy and Medical Biochemistry | 2                | Zagreb       |
| Faculty of Food technology and Biotechnology | 2                | Zagreb       |
| Arboretum Trsteno                            | 2                | Dubrovnik    |
| Institute of Adriatic Agriculture            | 1                | Split        |
| Forest Research Institute                    | 1                | Jastrebarsko |
| Secondary school                             | 1                | Požega       |
| Primary school                               | 1                | Murter       |
| Total of papers                              | 112              |              |

As to be expected, most of the papers come from the Faculty of Science, Biology Division, because this is the journal's home institution. In total, 13 institutions showed up in the material analysed, most of them being scientific institutions (faculties and institutes). If one looks at the degree to which the individual parts of Croatia are represented, it can be seen that almost all the scientific institutions that deal with this problem area are represented. Nevertheless, since 1998, although this is a short period, the structure of institutions from Croatia represented has changed. The number has reduced, only 6 institutions now figuring, with the domination of PMF (Science Faculty) Zagreb. However, the number of works from abroad has considerably risen, and by 2000 had grown to 57% of all works, as against 13.8% in the period from 1991 to 1999 (Tab. 2).

**Tab. 2.** The degree to which different foreign countries are represented by foreign authors, and distribution per year

| Country           | Number of papers | Distribution per year                     |
|-------------------|------------------|---|
| Italy             | 12               | 1/1994; 3/1995; 1/1996–97; 2/1998; 5/2000 |
| Slovenia          | 5                | 2/1995; 1/1999; 2/2000                    |
| Hungary           | 4                | 1/1998; 3/2000                            |
| Austria           | 3                | 2000                                      |
| Japan             | 2                | 1/1995; 1/1998                            |
| Kosovo/Yugoslavia | 1                | 1991                                      |
| India             | 1                | 1991                                      |
| Denmark           | 1                | 1994                                      |
| Germany           | 1                | 2000                                      |
| Czech R           | 1                | 2000                                      |
| Ukraine           | 1                | 2000                                      |
| Total             | 32               |   |

A fact that should certainly be noted is the increased cooperation with a large number of countries that previously had not been represented by works in ABC, for example, with Austria, Hungary, Germany, Czech R and Ukraine. Also to be noted is more vigorous cooperation with countries that have already been represented in ABC, for example Italy and Slovenia.

### **The extent to which the journal *Acta botanica croatica* is cited**

One of the indicators of the value of some journal is the response it evokes in the scientific community, and this can be measured through citations papers that the journal publishes. So far the best known, and the only, system that is taken as a scientometric aid, is the number of citations measured through the so-called Impact Factor, IF, given by ISI in its publication Journal Citation Report (JCR). According to this system, only journals that are represented in the corpus of the ISI databases can have IF. Hence, the journal ABC cannot have it. However, since the WoS (Web of Science), the ISI citation data base, is available, we have drawn up a list of the degree to which ABC has been cited per year. From these data an IF could be calculated, but in this research we have not embarked on this aspect. Table 3 will show the total number of citations, the number of citations per year, and the distri-

bution of the years of citation. The total number of citations was 214, with ABC being cited only 15 times in 1992, but as many as 38 times in 2000. It can be seen that authors refer to papers from ABC that are from 17 to 35 years old. The numbers quoted do not mean a great deal by themselves, but with interpretation and comparison with the cited papers can be an indicator of, for example, the research areas, the degree to which authors are acquainted with the literature and so on.

**Tab. 3.** The degree to which the journal ABC is cited in the 1991–2000 period

| Year  | Number of citations | Range of cited literature |
|-------|---------------------|---------------------------|
| 1991  | 16                  | 1969–1989                 |
| 1992  | 15                  | 1970–1991                 |
| 1993  | 18                  | 1962–1990                 |
| 1994  | 20                  | 1972–1989                 |
| 1995  | 17                  | 1972–1994                 |
| 1996  | 25                  | 1970–1994                 |
| 1997  | 22                  | 1957–1994                 |
| 1998  | 27                  | 1965–1994                 |
| 1999  | 16                  | 1957–1994                 |
| 2000  | 38                  | 1960–1995                 |
| Total | 214                 |                           |

Of the 214 citations, 161 or 72.5% of all citations are accounted for by papers by Croatian authors. This fact is relatively in line with the proportion of papers written for ABC by Croatian authors in the period under analysis.

The total number of authors who cited papers from ABC in this period was 172. The difference between number of citations and number of authors arose from the fact that some authors or papers were cited several times. Of this, there were 38 local authors, or 22%, and 134 foreign, or 77%. Citations from local authors have not been separately analysed, but they can be self-citations of authors who have published papers in the body of journals covered by the SCI, citing their own previous works, or independent citations of Croatian authors, referring to the results of other authors published in ABC. The fact that 78% of the authors who cited works from ABC were foreign indicates that the journal is relatively highly internationally visible.

### **International journals that have cited *Acta botanica croatica***

As already mentioned, among other things, it is the number and characteristics of the journals that cite it that are indicators of the communicability of some journal. By a more detailed analysis of the journals in the SCI (via the WoS database) that cite ABC, we have arrived at the data given in Tables 4 and 5.

In this period, then, a total of 101 journals, the contents of which are dealt with in SCI, have referred to papers from ABC. Since ABC covers a relatively broad area, it is hard to compare it with journals that deal with molecular genetics or floristic studies, because there is a completely different dynamics and structure of research. A comparison of for example

**Tab. 4.** Journals that have cited ABC more than once in the period 1991–2000.

| Title  | Country     | Impact Factor | Number of citations |
|--|-------------|---------------|---------------------|
| 1. Periodicum biologorum   | Croatia     | 0.213         | 9                   |
| 2. Journal of plant physiology   | Germany     | 0.943         | 7                   |
| 3. Biologia plantarum  | Netherlands | 0.424         | 4                   |
| 4. Mycotaxon   | USA         | 0.372         | 4                   |
| 5. Plant cell tissue and organ culture                                 | Netherlands | 0.444         | 4                   |
| 6. Plant physiology and biochemistry                                   | France      | 1.292         | 4                   |
| 7. Acta biologica Cracoviensia:series botanica                         | Poland      | 0.314         | 3                   |
| 8. Annales botanici Fennici  | Finland     | 0.269         | 3                   |
| 9. European journal of plant pathology                                 | Netherlands | 1.090         | 3                   |
| 10. Molecular biology  | USA         | 0.477         | 3                   |
| 11. Mutation research (There are 5 titles with an IF of 1.29 do 3.37!) | Netherlands |               | 3                   |
| 12. Photosynthetica  | Czech R     | 0.482         | 3                   |
| 13. Physiologia plantarum  | Denmark     | 1.476         | 3                   |
| 14. Phytion  | Austria     | 0.096         | 3                   |
| 15. Plant cell reports   | Germany     | 1.277         | 3                   |
| 16. Protoplasma  | Austria     | 1.333         | 3                   |
| 17. Acta oecologica  | France      | 0.672         | 2                   |
| 18. Acta virologica  | Slovakia    | 0.558         | 2                   |
| 19. Biologia   | Slovakia    | 0.165         | 2                   |
| 20. Biotechnology and biotechnological equipment                       | Bulgaria    | 0.098         | 2                   |
| 21. Canadian journal of botany   | Canada      | 0.816         | 2                   |
| 22. Caryologia   | Italy       | 0.361         | 2                   |
| 23. Euphytica  | Netherlands | 0.621         | 2                   |
| 24. Flora  | Germany     | 0.708         | 2                   |
| 25. Folia geobotanica  | Czech R     | 0.649         | 2                   |
| 26. Hortscience  | USA         | 0.470         | 2                   |
| 27. Internationale revue der gesamten Hydrobiologie                    | Germany     | 0.018         | 2                   |
| 28. Israel journal of plant science                                    | Israel      | 0.512         | 2                   |
| 29. Journal of applied botany  | Germany     | 0.423         | 2                   |
| 30. Journal of ecology   | UK          | 2.535         | 2                   |
| 31. Journal of experimental botany                                     | UK          | 2.314         | 2                   |
| 32. Journal of general virology  | UK          | 3.126         | 2                   |
| 33. Journal of phytopathology  | Germany     | 0.442         | 2                   |
| 34. Mycological research   | USA         | 1.133         | 2                   |
| 35. Physiological and molecular plant pathology                        | UK          | 1.970         | 2                   |
| 36. Plant pathology  | UK          | 0.903         | 2                   |
| 37. Plant science  | Eire        | 1.259         | 2                   |
| 38. Sedimentary geology  | Netherlands | 1.182         | 2                   |
| 39. South African journal of botany                                    | RSA         | 0.317         | 2                   |
| 40. Vegetatio  | Germany     | –             | 2                   |
| 41. Water air and soil pollution                                       | Netherlands | 0.632         | 2                   |

**Tab. 5.** Journals in which ABC has been cited once in the period 1991–2000.

| Title   | Country     | Impact Factor |
|---|-------------|---------------|
| 1. Acta physiologiae plantarum                      | Poland      | 0.269         |
| 2. Acta theriologica                                | Poland      | 0.422         |
| 3. Advances in agronomy                             | USA         | 2.419         |
| 4. Agronomie  | France      | 0.510         |
| 5. Allgemeine Forst und Jagdzeitung                 | Germany     | 0.239         |
| 6. Protist  | Germany     | –             |
| 7. Archiv fuer Hydrobiologie                        | Germany     | 1.072         |
| 8. Archives of virology                             | Austria     | 1.705         |
| 9. Australian journal of agricultural research      | Australia   | 0.866         |
| 10. Biological conservation                         | UK          | 1.578         |
| 11. Biological journal of the Linnaean society      | UK          | 2.316         |
| 12. Biological trace element research               | USA         | 0.786         |
| 13. Biology and fertility of soils                  | USA         | 1.307         |
| 14. Botanica acta                                   | Germany     | 1.323         |
| 15. Botanical journal of the Linnaean Society       | UK          | 1.525         |
| 16. Canadian journal of forest research             | Canada      | 0.955         |
| 17. Cell proliferation                              | UK          | 0.955         |
| 18. Chemosphere                                     | UK          | 1.033         |
| 19. Critical reviews in plant sciences              | USA         | 3.422         |
| 20. Cryptogamie mycologia                           | France      | 0.300         |
| 21. Environmental and experimental botany           | UK          | 0.873         |
| 22. European journal of phycology                   | UK          | 1.276         |
| 23. Experientia                                     | Switzerland | –             |
| 24. Folia microbiologica                            | Czech R     | 0.752         |
| 25. Forstwissenschaftliches Centralblatt            | Germany     | 0.263         |
| 26. Hydrobiologia                                   | Netherlands | 0.582         |
| 27. International journal of plant sciences         | USA         | 1.069         |
| 28. International review of cytology                | USA         | 7.637         |
| 29. Israel journal of zoology                       | Israel      | 0.346         |
| 30. Journal of biogeography                         | UK          | 1.440         |
| 31. Journal of coastal research                     | USA         | 0.703         |
| 32. Journal of microbial biotechnology              | India       | 1.083         |
| 33. Journal of plankton research                    | UK          | 1.084         |
| 34. Journal of plant biochemistry and biotechnology | India       | 0.143         |
| 35. Journal of structural biology                   | USA         | 3.255         |
| 36. Journal of vegetation science                   | Sweden      | 1.589         |
| 37. Lindbergia                                      | Denmark     | 2.165         |
| 38. Microscopy research and technique               | USA         | –             |
| 39. Natural product reports                         | UK          | 5.295         |
| 40. Netherlands journal of plant pathology          | Netherlands | –             |
| 41. Nova Hedwigia                                   | Germany     | 0.488         |
| 42. Noenytermeles                                   | Hungary     | 0.246         |
| 43. Phycologia                                      | UK          | 0.950         |

**Tab. 5.** – continued

| Title   | Country     | Impact Factor |
|---|-------------|---------------|
| 44. Phytochemistry                                  | UK          | 1.112         |
| 45. Phytocoenologia                                 | Germany     | 0.414         |
| 46. Plant and soil                                  | Netherlands | 1.218         |
| 47. Plant biology                                   | Germany     | 1.215         |
| 48. Plant disease                                   | USA         | 1.203         |
| 49. Plant molecular biology                         | Netherlands | 3.226         |
| 50. Plant systematics and evolution                 | Austria     | 1.408         |
| 51. Quaternary research                             | USA         | 2.385         |
| 52. Radiocarbon                                     | USA         | 2.234         |
| 53. Russian journal of plant physiology             | Russia      | 0.214         |
| 54. Science of the total environment                | Netherlands | 1.252         |
| 55. Silvae genetica                                 | Germany     | 0.312         |
| 56. Soil science society of America journal         | USA         | 1.401         |
| 57. Studies in mycology                             | Netherlands | 2.375         |
| 58. Symbiosis                                       | Israel      | 0.891         |
| 59. Vegetation history and archaeobotany            | USA         | 1.233         |
| 60. World journal of microbiology and biotechnology | Netherlands | 0.538         |

the IF for the given areas, only on the basis of the IF number, could lead to false conclusions. In this table the IFs are given only for the purpose of orientation. By way of setting the context, we shall quote the item of information that among the 200 most cited journals, or the journals with the highest IF (JOURNAL CITATION REPORTS, 2002)) for 1999, the highest IF being 45.564 for the Annual Review of Immunology and the lowest being 4.95, only two are represented in our list. Since this is a very delicate topic, we leave debate about IF for some later investigation.

Table 5 shows that 60 (59.4%) of journals cite only one paper each from ABC. Twenty five or 24.6% of journals cite two articles from ABC, and three articles are cited by 10 international journals. The following journals refer to the results of papers in ABC four or more times: *Periodicum biologorum*, *Journal of plant physiology*, *Biologia plantarum*, *Mycotaxon*, *Plant cell tissue and organ culture* and *Plant physiology and biochemistry* (Tab. 4). If we exclude the citations from our own journal *Periodicum biologorum*, which are on the whole self-citations by authors, then the periodical *Journal of Plant Physiology* is most open to papers from ABC, with seven citations.

As well as the indicator about the number of international journals that make up the core of today's science and the number of times which papers from ABC are referred to, also significant is information about in which countries these journals are published (Tab. 6).

The datum that papers from ABC are cited by journals originating in 24 countries suggests that papers from ABC are visible and accessible to the world's scientific community. For more data and a more detailed explanation, a very exhaustive qualitative analysis of the citations would be required.



**Tab. 6.** Countries of journals that cite ABC

| Country         | Number of citations |
|-----------------|---------------------|
| 1. Germany      | 29                  |
| 2. Netherlands  | 26                  |
| 3. USA          | 26                  |
| 4. UK           | 22                  |
| 5. Croatia      | 9                   |
| 6. Austria      | 8                   |
| 7. France       | 8                   |
| 8. Czech R      | 6                   |
| 9. Poland       | 5                   |
| 10. Denmark     | 4                   |
| 11. Israel      | 4                   |
| 12. Slovakia    | 4                   |
| 13. Finland     | 3                   |
| 14. Canada      | 3                   |
| 15. Bulgaria    | 2                   |
| 16. Eire        | 2                   |
| 17. Italy       | 2                   |
| 18. RSA         | 2                   |
| 19. Australia   | 1                   |
| 20. Hungary     | 1                   |
| 21. Russia      | 1                   |
| 22. Sweden      | 1                   |
| 23. India       | 1                   |
| 24. Switzerland | 1                   |

### Conclusion

The scientometric analysis of *Acta botanica croatica* indicated the communicability of this journal at an international level. The journal is a medium of communication for the scientific problem. If its communicability or its visibility and accessibility to the general scientific community is small, then its fulfilment of its function is questionable. During the period 1991 to 2000, the concept changed: from 1998 on, all the original scientific papers, except those already accepted, have been written only in English, which has mean the potential accessibility has increased; the proportion of foreign authors has also risen, which is one of the basic indicators of the communicability of a journal. The journal has started to come out more dynamically since 2000, with two numbers a year, the number of papers also rising.

Apart of number of citations, according to Science Citation Index (SCI), a list is provided of the journals that have referred to papers from *Acta botanica croatica* and their frequency. Articles from our journal have been cited by 101 journals from 24 countries during the period under analysis.

The degree of communicability of a journal can be measured more easily if we have results from similar investigations at our disposal. This is at the same time a challenge for the continuation of investigation so that the journal should be able to carry out its basic function as well as possible.

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