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## National Center for Biotechnology Information (NCBI) database search for rubber plant *Hevea brasiliensis*

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**Abstract.** The present study describes search National Centre for Biotechnology Information (NCBI) databases (GQuery) on rubber plant *Hevea brasiliensis* Mull. Arg. NCBI databases search (<https://www.ncbi.nlm.nih.gov/>) was employed to generate a number of valuable information. Results found in 26 databases for *H. brasiliensis*. All databases of the rubber plant consist of literature, genes, genes, protein genomes, and chemical properties of *H. brasiliensis*. It is noteworthy no information concerning genetics. The literature contained bookshelf, MeSH (Medical Subject Headings), National Library of Medicine Catalogue, PubMed, and PubMed Central. Health comprised only OMIM (Online Mendelian Inheritance in Man database), Gene consists of EST, Gene, GEO DataSets, and PopSet. No Genetics data available for *H. brasiliensis*. Proteins feature contained Identical Protein Groups, Protein Clusters, Sparcle, and Structure. Genomes included Assembly, BioCollections, BioProject, BioSample, Genome, GSS, Nucleotide, Probe, SRA, and Taxonomy. The chemicals property denoted BioSystems and PubChem BioAssay. The present work provides essential information relating to biotechnology.

### 1. Introduction

*Hevea brasiliensis* Mull. Arg. is now used solely for the commercial production of natural rubber. Over 2500 plant species are known to produce natural rubber consists [1]. *H. brasiliensis* is widely studied for their biological and physiological activities [2-5]. For example, physiological and molecular responses of *H. brasiliensis* to abiotic stress such as drought and light [2-3]. The genes were associated with tapping panel dryness in *H. brasiliensis* has been reported [4].

Furthermore, polyisoprenoids have been described in various organs of rubber plant [5]

Even though large number studies in *H. brasiliensis* have been well documented, limited works have been focused on the information relating biotechnology occurred in the rubber plant from all databases available. Here we attempted another method through a favourite search engine to collect valuable information needed in recent studies of biotechnology-related sciences. The present study, therefore, aimed to report the application of National Centre for Biotechnology Information (NCBI) databases



(GQuery) search to get more insight much valuable information on updated biotechnology on rubber plant *H. brasiliensis*.

## 2. Materials and Method

NCBI databases search engine (<https://www.ncbi.nlm.nih.gov/>) was employed to generate a number of valuable information biotechnology about the rubber plant. Databases were accessed by writing *Hevea brasiliensis* in all databases search as mentioned earlier on September 19, 2018. The feature was all databases consisting of the literature, health, genes, protein, genomes and chemical properties of *H. brasiliensis* was carried out using (GQuery). The information factors contained the bookshelf, MeSH (Medical Subject Headings), NLM (National Library of Medicine) Catalogue, PubMed, PubMed Central, EST, Gene, GEO datasets, PopSet, Identical Protein Groups, Protein, Sparkle, Structure, Assembly, BioProject, BioSample, Genome, GSS, Nucleotide, Probe, SRA, Taxonomy, Biosystems, and PubChem BioAssay.

## 3. Results and Discussions

Table 1 shows literature available in the NCBI relating to *H. brasiliensis*. Five biographies with numerous numbers deposited. The NCBI literature online is providing online libraries and free access information of bookshelf (four books and reports), 13 MeSH (Medical Subject Headings), ontology used for indexing articles for PubMed. Furthermore, two NLM catalogue reported, 1031 PubMed and 1031 PubMed Central documentation in the rubber plant (Table 1). The PubMed database contains citations from various subjects in *H. brasiliensis*, many links to reports of rubber plant full-text articles open access.

**Table 1.** Literature source NCBI database for *H. brasiliensis*

Literature	Number	Description
Bookshelf	4	Books and reports
MeSH	13	Ontology used for PubMed indexing
NLM Catalogue	2	Books, journals and more in the NLM Collections
PubMed	1031	Scientific and medical abstracts/citations
PubMed Central	1829	Full-text journal articles

Information on genes sources and health as well is depicted in Table 2. This information is including genes related to tapping panel dryness to rubber latex [4]. Furthermore, genes involving abiotic stress tolerance have been deposited in the NCBI also can be accessed online through this system [2-3]. It is interesting to note that the OMIM (Online Mendelian Inheritance in Man) was detected in this study (Table 2). OMIM offers assistance to researchers in the complex relationship between genes and disease, thoroughly characterized and insight of the underlying complex characteristics of collected infections [6]. It is noteworthy that large Expressed Sequence Tags (EST) along with genes has been deposited in the database.

Gene expression omnibus (GEO DataSets) is also available for *H. brasiliensis* to study functional genomics. PopSet is useful to investigate the phylogenetic and population studies in a rubber plant. The PopSet was 167 as shown in Table 2. The NCBI resource for *H. brasiliensis* organizes information on genomes characteristic including four assemblies, 57 biological projects providing data, 618 descriptions of biological source materials and one genome sequencing project, 294 GSS (Table 3). *H. brasiliensis* had 188278 nucleotides derived from DNA and RNA sequences have been described (Table 3). On the other hand, also available one taxonomic classification and nomenclature of the catalogue, 1145 sequences-based probes and primers, and 195 SRA (sequence read archive), that is high-

throughput read sequences (Table 3). One genome assembly of rubber plant has been deposited, the genome project namely ASM165405v1 from Rubber Research Institute.

**Table 2.** Genes source NCBI database for *H. brasiliensis*.

Genes/Health	Number	Description
OMIM	10	Online Mendelian Inheritance in man
EST	52770	Expressed sequence tag sequences
Gene	42689	Collected information about gene loci
GEO DataSets	63	Functional genomics studies
PopSet	167	Sequence sets from phylogenetic and population studies

**Table 3.** Genomes source NCBI database for *H. brasiliensis*.

Genomes	Number	Description
Assembly	4	genome assembly information
BioProject	57	biological projects providing data to NCBI
BioSample	618	descriptions of biological source materials
Genome	1	genome sequencing projects by the organism
GSS	294	genome survey sequences
Nucleotide	188278	DNA and RNA sequences
Probe	1145	sequence-based probes and primers
SRA	195	high-throughput read archive
Taxonomy	1	taxonomic classification and nomenclature catalog

**Table 4.** Proteins source NCBI database for *H. brasiliensis*.

Proteins	Number	Description
Identical Protein Groups	48501	protein sequences grouped by identity
Protein	61788	protein sequences
Sparkle	3	Functional categorization of proteins by domain architecture
Structure	45	Experimentally-determined biomolecular structures

Nucleotide or FASTA base sequences for genomes can be downloaded on the GFF menu, currently available in 1 genome in GenBank BLAST from NCBI for *H. brasiliensis*. Pop sequence genes sets have six from phylogenetic and population studies (Table 3). Numerous proteins belong to rubber plant have been available online in the database (Table 4). There were 61,788 protein sequences, 48,501

protein sequences joined by similarity, three protein species, and 45 protein structures. Recently some papers have been reported to predict protein structure using protein sequences or DNA sequences using Phyre2 and Swiss-model online [8-9].

Variation of chemical characteristics of the *H. Brasiliensis* is displayed in Table 5. There were 152 molecular pathways with links to genes, proteins, and chemicals. Two bioactivities screening works are online available. As previously reported that rubber plant is an abundance of polyisoprenoid compound [5]. Polyisoprenoids are characterized in higher plants including rubber plant [5], mangroves [10-11], coastal plant [12], oil palm plantation [13-14], and others.

**Table 5.** Chemicals source NCBI database for *H. brasiliensis*.

Chemicals	Number	Description
BioSystems	152	molecular pathways with links to genes, proteins, and compounds
PubChem BioAssay	2	bioactivity screening studies

#### 4. Conclusions

The NCBI online describes various biological and biotechnology information on the rubber plant. The present work encouraged researchers in the biotechnology field to gain more benefits using the NCBI search engine.

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