

Collective Intelligence for Thai Herbal Information

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ABSTRACT .

Traditional knowledge about Thai herbal medicine can be contributed from several cultures. With the conventional techniques, it is hard to find the way which herbal specialists can build a community for exchanging their knowledge. To alleviate the problem of gathering information based on different cultures, the Knowledge Unifying Initiator for Herbal Information (KUIHerb) is used as a platform for building a web community for collecting the intercultural herbal knowledge. KUIHerb provides a capability in expressing the information about local names, part of herb in usages, indications, methods for preparation and toxicity. In case of multiple opinions are provided, the popular vote will select a set of more preferable opinions used in the community. Basic knowledge in both text and images are used for common understanding. With this system, herb identification, new medicinal applications, precautions including toxicity and references can be collected.

KEY WORDS -- Herbal information, Collective intelligence, KUI, KUIHerb

บทคัดย่อ

ความรู้ดั้งเดิมเกี่ยวกับสมุนไพรไทยได้มาจากหลายชุมชน ด้วยวิธีการแบบเดิมนั้นเป็นการยากที่จะทำให้ผู้เชี่ยวชาญด้านสมุนไพรสร้างชุมชนสำหรับการแลกเปลี่ยนความรู้ เพื่อลดปัญหาที่เกิดขึ้นจากการรวบรวมข้อมูลจากหลายชุมชน ระบบสถาปนาองค์ความรู้ด้านสมุนไพร (คุยเอิร์บ) ได้ถูกสร้างขึ้นเพื่อใช้เป็นเครื่องมือสำหรับการสร้างชุมชนบนเว็บเพื่อรวบรวมข้อมูลสมุนไพรหลากหลายชุมชน คุยเอิร์บมีความสามารถในการให้ข้อมูลชื่อท้องถิ่นของพืชสมุนไพร ส่วนที่ใช้ สรรพคุณ วิธีการเตรียมสมุนไพร รวมถึงข้อควรระวังและเป็นพิษ ในกรณีที่มีความเห็นหลากหลายเกิดขึ้น ระบบจะใช้วิธีการลงคะแนนเสียง และจะเลือกความเห็นชุดหนึ่งที่ตัดสินใจได้จากชุมชนนั้น ข้อมูลพื้นฐานทั้งชนิดข้อความและรูปภาพ จะถูกนำมาใช้สร้างความเข้าใจพื้นฐานร่วมกัน ด้วยระบบนี้ การพิสูจน์เอกลักษณ์ของพืชสมุนไพร แนวทางการประยุกต์ด้านการแพทย์ ข้อควรระวังรวมทั้งความเป็นพิษของพืชสมุนไพร และเอกสารอ้างอิงได้ถูกรวบรวมไว้

คำสำคัญ – ข้อมูลพืช ปัญญารวมหมู่ คุย คุยเอิร์บ

1. Introduction

Many of Thai traditional medical treatments have been derived the origins in India. They have their roots in ancient Indian Ayurvedic practices. Medicinal usages are different from each other according to the different part used, method of preparation and their cultural

background. The study on intercultural herbal information development will not only form a cross cultural community of the knowledge but also encourage the discovery of new herbal knowledge. To find a meaningful information, data mining is the process for achieving the goal through large amount of data. Data

mining is usually applied on business data. However, it is quite a few studies on herbal information. Several data mining techniques i.e., classification, clustering, association rules and etc., can be applied on herbal information. In the process of collecting herbal information for efficient data mining applications, a large group of community should be considered for exchanging information. It needs to find tools which enable users to publish their useful information, share knowledge, and discussing until to find the good answer for the question. Due to the large collaboration, the Internet, especially World Wide Web, is useful for connecting the large group of people.

The second phase in the Web's evolution so-called Web 2.0, is attracting. Unlike Web 1.0 which only allows users access to a Web site and contribute their information or knowledge to it, Web 2.0 keeps up with a site's content even without visiting the real Web document. Web 2.0 is more interactive and collaborative approach, emphasizing social interaction, and collective intelligence of users. Collective intelligence is the combination of individual intelligence. It can be considered as a complex adaptive system. As the adaptive agents act individually and mutually, collective intelligence gradually emerges [1]. In Web 2.0, it is abundance of information. However, it provided only a little bit on control of information. The opinions of the discussion topic are usually collected from general Internet users. This causes the controversial agreement. The new generation of Web technology, Web 3.0, should be better for creating new accurate and reliable knowledge which is very important especially medicinal knowledge. It can be considered as semantic Web. It provides some mechanisms for less controversial of the opinions and more control of information [2].

In this paper, we address the problem of collecting herbal information in many topics. One of the difficulties in constructing a knowledge base for the different cultures is the development of a communication tool for realizing a self-sustainable community. To alleviate this problem, the creativity support system is so-called the Knowledge Unifying Initiator for Herbal Information (KUIHerb), is used as a platform for building a web community for collecting the intercultural herbal knowledge. It should be implemented with the concept of Web 2.0 and some characteristics of Web 3.0. KUIHerb provides a capability in expressing the information about part of herb in local names, usages, indications, methods for preparation, precautions and toxicity. For medicinal herb identity, we use the scientific name and its images for common understanding. In case of multiple opinions are provided, the popular vote will select the more preferable opinions used in the community. Data which are collected by KUIHerb will be applied later for data mining.

In the rest of this paper, Section 2 presents the collective intelligence with Web 2.0 and 3.0. The concept of herbal

information is described in Section 3. Section 4 gives a detail of the aims of the KUIHerb. Components of the KUIHerb is given in Section 5. Experimental Result is described in Section 6. A conclusion and future works is made in Section 7.

2. Collective Intelligence with Web 2.0 and 3.0

The global buildup of the Internet connectivity and growing availability of less expensive computing and communication devices have made the World Wide Web, an important media for exchanging information among users around the world. Anyone with a computer and the Internet access can now participate, build or abandon any Web community at anytime. In Web 2.0 era, the Internet users easily share opinions and resources. Consequently, users can collectively contribute to the Web community and generate massive content behind their virtual collaboration [3]. As suggested by Gruber T., the true collective intelligence can be considered if the data collected from all those participants is aggregated and recombined to create new knowledge and new ways of learning that individual humans cannot do by themselves [4].

In order to make this situation true, Web 2.0 system should be simple, scalable, and sensible. Due to the fact that the user is considered to be the most important component in Web 2.0, providing friendly tools for user participation in content creation, consumption and distribution has been the key to success of the system. Another key to success is technology which makes Web sites more scalable. For a system with collective intelligence, implementing scalability can indeed be challenging, but sensibility comes at variable sophistication levels. Several approaches are dealing with the sensibility e.g., user feedback, recommender systems, search engine, and mashups. For user feedback, hit counters can be represented Web sites' relative popularity, while the volume of contents which users contribute to the system provides a measure of user participation. The recommender system utilizes some technologies such as filtering technologies to point users to objects of interest. In Web 2.0 sites, they usually include search engines to help users find content which the members in the community have created. The new version of search engine utilizes a combination of data content (term and document statistics), data context (URL with a file name), and the number of incoming links. Mashups are a simple and powerful content creation technology that allows users integrate information from multiple sources to provide an enriched experience. Web 2.0 brings Internet users together in a more interesting, interactive space. Information from practitioners such as health team professional is connected. With this environment, knowledge exchange is not limited by private interests [5]. In Web 2.0, a large

group of Internet users can be collaborated. However, it provided only a little bit on control of information. Nowadays, we are going to the new generation of Web technology i.e., Web 3.0. It is also called the semantic Web. Some useful features of Web 3.0 are described as follow. In Web 3.0, it can be considered as “The data Web” instead of “The document Web” in Web 2.0. The control of sharing information is better. The decision for the opinions which are provided in Web 3.0, is more accurate. The intelligence Web is a new important feature in Web 3.0 while in Web 2.0, it is only the social Web [2]. Unlike Web 2.0 which participants are usually general Internet users, wisdom of the expert is essential for constructing more valuable knowledge. From these features of Web 3.0, it should be a better collective intelligence system for building new knowledge by way of Information Technology (IT), especially medical knowledge, and herbal knowledge should be no exception. In this work, the Knowledge Unifying Initiator for Herbal Information, is used as a platform for building a web community for collecting the Thai herbal knowledge.

3. Herbal Information

Herbal information is a special type of information dealing with medicinal herbs. Information of these herbs both in scientific and traditional information can be easily found on the Internet. In Thailand, at least 2500 species of flora have been used as herbal medicine [6]. In case of traditional medicine, most of the plants have more than one name (a local name) such as *Dracaena loureiri* Gagnep. We use its hard wood for fever and call Chan dang. Some time we call this plant in other names up to the area of country, e.g., Chan pha (northern part) and Lakka chan (central part) [7]. The relationship between an herb and its part used as well as its indication, is many to many. A medicinal herb composes of several parts. There are some parts which can be used for medicinal proposes. However, their indications may be different. It depends on different cultures, location and methods for preparation. Furthermore, There are evidences that some herbs have toxicity. The precautions for applying these herbs, is an important topic for sharing experiences. If an impressive system for collecting herbal information can be implemented and operated in a period of time, we can apply data mining on herbal information. A professional can find information of an herb from a standard monograph. It is a type of monographs usually found in a pharmacopoeia. It deals with information to determine the proper identity of a plant genus or genus and species. This includes the taxonomy and nomenclature of the plant (according to the Linnean system of botanical classification and nomenclature, including all synonyms), botanical description of the whole plant and plant parts, microscopic descriptions of cellular structures of various plant parts, and various chemical assays to determine identity and purity.

4. The Aims of the KUIHerb

The Knowledge Unifying Initiator (KUI) is a GUI for knowledge engineering. It provides a web interface accessible for pre-registered members [8]. A contributor can comfortably move around in the virtual space from desk to desk to participate in a particular task. A working desk can be a meeting place for collaborative work that needs discussion through the 'chat', or allow a contributor to work individually by using the message slot to record each own comment. The working space can be expanded by closing the unnecessary frames so the contributor can concentrate on the task. A knowledge community can be formed and can efficiently create the domain knowledge through the features provided by the KUI. These KUI features fulfill the process of human thought to record the knowledge. The original of KUI, is available at <http://www.tcllab.org/kui>. However, it has been modified for collecting herbal information so-called KUI for Herbal Information (KUIHerb for short). The aims of KUIHerb are described as follow:

4.1 Gathering Herbal Information from Multicultural Environments

To gather herbal information efficiently, the system has been designed for three levels of users based on their contribution patterns. The simplest group, general users who would like to view the content only. The second group is a member group who gets right for contributing his/her information to the existing herbs. A user of the member group, can share and vote the opinions in the system. The last group and the most powerful group of users, is an administrative group. A user of this group gets right for inserting a new herb into the system and also grant right to the other users. General characteristics, initial basic information about the new herb is contributed by a user in an administrative group to make the system is more interesting. For improving a quality of herbal information, references can be given.

4.2 Identifying a Real herb in Traditional Herbal Formulas

Herbal medicine has been used for a long time. However, some problems are still presented such as name identification and their medicinal uses which may be different among cultures. For instance, the same species of herb may be known by different names in different areas. On the other hand, a certain herbal name may mean one thing in one area but something completely different in another. Lack of information about native herbs has made them more difficult for applying. The systematic collecting of herbal information among cultures is valuable for development of both traditional and modern herbal medicines. Although professional can find herbal information from a pharmacopoeia, information from these sources is limited. In the case of the herb does not appear in the pharmacopoeia, it is hard to seek accurately information about the herb. The images of an herb are excellent for sharing knowledge

about herb identity. From the images, the users can discuss which species (including variety) it should be. The scientific name of an herb and its images are used for common understanding. Furthermore, the users can discuss about which herb should be the real herb (exact species) that appears in traditional herbal formulas. The images for each part which can be applied for medicinal uses, should be added to the system. Some keywords for each image should be added for more understand and searching.

4.3 Identifying New Applications of the Well-known Herbs

Medicinal uses may be different among cultures. Clinicians need to be aware of the herbal healing traditions of a diverse patient population. For example, there is a variety of uses suggested for ginger in term of medicinal usages. Tea brewed from ginger is a folk remedy for colds. Ginger ale and ginger beer have been recommended as "stomach settlers" for generations in countries where the beverages are made. Ginger water was used to avoid heat cramps in the US. Ginger has also been historically used to treat inflammation which several scientific studies support, though one arthritis trial showed ginger to be no better than a placebo or ibuprofen [9]. Research on rats suggests that ginger may be useful for treating diabetes [10].

Simultaneously, the increasing popularity of complementary and alternative therapies means that clinicians need evidence based information on the herbal supplements taken by all patients. In herbal medicine, a therapeutic monograph usually provides a definition of the plant drug (i.e., plant part, nomenclature, etc.), a listing of key chemical compounds, indications, contraindications, side effects, dosage (including per unit and total daily intake), form of administration (i.e., the dosage in powder, tea, tablet or capsule, liquid extract, etc.), duration of use, interactions with other medications, and so on. In order to expand information in standard herbal pharmacopoeia, information for each topic should be discussed from contributors in community. A contributor can post an opinion on the selected topic. Any opinions committed to voting. Opinions can be different but majority votes will cast the belief of the communities. These features naturally realize the online collaborative works to create the knowledge communities. With this method, new applications for an herb can be found and distributed to another community. This is not only medicinal usages but also other applications such as a new method for extracting some substances from herbs to produce painting color.

5.4 Identifying Precautions, Toxicity and Additional Information

Although several herbs are usually used, they may caused some problems. Some herbs may have toxicity in a different situation. For example, Some patients are more sensitive to certain herbs and some have more tolerance for some other herbs. For example, *Ginkgo*

biloba L. is very toxic to young children. Small children of few years old have died from taking just less than ten pieces of *Ginkgo biloba* L. seeds [11]. Adults are rarely affected by its toxicity but this does not mean it will not happen. Some problems occur from the method of preparation. For example, dried exudate from the *Aloe vera* (L.) Burm.f. leaf (not gel of its leaves) also contains anthranoids and is used as a laxative. *Aloe vera* gel, found within the leaves, is used topically for burns and cuts, and is sometimes recommended by herbalists for internal ingestion to treat ulcers and other disorders. The gel (or juice made from the gel) does not contain anthranoids, but some oral preparations are contaminated by the laxative portion [12]. Some people may have these problems. It would be better to share their experiences on the Internet. This is very useful for other people who would like to use the herb.

5. Components of the KUIHerb

Four components are implemented in the KUIHerb i.e., sharing and collecting information, providing information, searching information and Web site statistics. The figure of the home page of the KUIHerb is shown in Figure 1. The detail of each component is described as follow.

5.1 Sharing and Collecting Information

For the first version of KUIHerb, six topics are taken into account for sharing and discussing about herbs i.e., general characteristics, images, local names, applications (including part used, indications and methods for preparation), precautions and toxicity. Among these topics, a poll-based system is implemented on local names and applications. With this system, a contributor may choose to work individually by posting his/her opinion about those topics. Any opinions or suggestions are committed to voting. Opinions can be different but majority votes will cast the belief of the communities. These features naturally realize the online collaborative works to create the knowledge communities. The weighting system for each opinion can be calculated by the formula

$$Wsum_{ik} = \sum_j w_{ijk}$$

Here, $Wsum$ is defined as the total weight (score) of the i th opinion of the k th topic. The w_{ijk} is the weight of the i th opinion which is given by the j th member who would like to vote in this opinion for the k th topic. The value of the w depends on the priority and agreeeness of the member. The priority or weight of the member, who contributes more accurate information for a long period, should be higher than the new one. The w is needed to update from a period of time. Furthermore, if the member agrees with the opinion, the value is positive and vice versa. A set of higher score opinions for each topic, trends to be more believable.

5.2 Providing Information

In the first version of KUIHerb, two approaches are constructed for providing herbal information. The first approach is the current news about herbal information by Web links. The administrator of the KUIHerb usually added news about herbs and it is easy to link to the source of information. The other approach, information of an herb is randomly selected from KUIHerb database when users visit the homepage of the Web site. It also provides a list of new herbs added to the database.

5.3 Searching Information

Information of an herb can be reached by two methods i.e., keyword search and directory search. KUIHerb provides the ability to keyword search by using a Thai common name, a Thai local name, an English name, a scientific name and a family of an herb. It also provides the ability to browse categories of part-used and symptoms.

5.4 Web Site Statistics

In order to know what is happening and up-to-the-minute

6. Experimental Results

The KUIHerb has been implemented using all open source software components. The scripting language is PHP. The data are collected in a database which is constructed with MySQL. With the Web 2.0 and some characteristics of Web3.0 concept, the system has been designed for general users who would like to participate. In the Figure 1, it shows the Web page for searching information by a directory and keyword. Web links to the current news and information of an herb has been provided to users. Three levels of access are defined i.e., 1) View Only - everyone may view the content of the Web site 2) Member - a group of users who get right for adding, changing and deleting his/her own information and 3) Admin - a group of users who get right for modifying all information. Four main parts of sharing and collecting information are implemented.

6.1 Herbal Identification

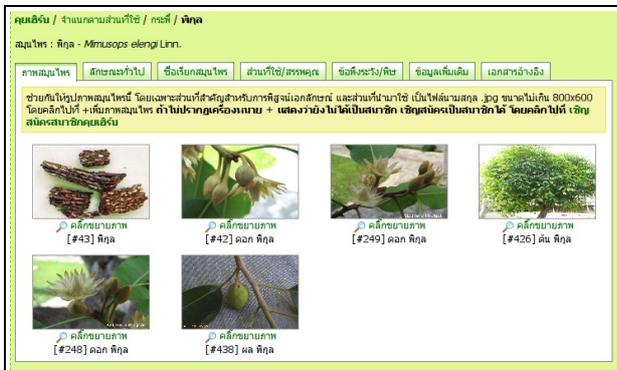
The scientific name of an herb and its images are used for common understanding. In this platform, not only the



Figure 1. The Four Components of the KUIHerb

data to make the right decisions that affect the growth of the KUIHerb community. Three set of statistics are created for these proposes. The first set is for a herbal database. It provides the number of herbs, news and topics in Web board. The second set is for describing the members of the community i.e., the number of member, the newest member, the number of active members of that time. The last statistical set reports the total activities in a period of day, month and year.

text content can be shared among members but also images of an herb can be uploaded to the system. This is very important for herbs whose part used rarely appear. The images should be described the whole plant. The parts which have medicinal usage such as leaves, roots, flowers, seeds, resin, root bark, fruit and sometimes the pericarp or other portions. They should be both in fresh and dry forms. The keywords and names of contributors can be provided to the system. When the pointing device is moved over a picture, the name of contributor for that picture will appear. Images and their keywords are shown in Figure 2.



6.2 Voting for Local Names and Usages

Members in KUIHerb can share and vote their information in two topics i.e., local name and usages. In the first topic, local names of herbs are suggested by members. Furthermore, the location in Thailand which

can be suggested. In case of a part with several indications and several methods for preparation, the opinion should be separated to an indication and a method of preparation for each part-used. The part-used, indications, method for preparations and their scores of *Mimusops elengi* L. (พิกุล) is shown in the Figure 3.

6.3 Sharing Information about Precautions and Additional Information

Two topics are separated from the others i.e., precautions (including toxicity) and additional information. These two topics are free text without voting the opinions. For a precaution, any suggestions will be kept for warning when someone would like to apply the herb (Figure 4). Although the voting system does not been applied to the opinion, different opinions can be given to the KUIHerb. For additional information, other valuable information such as cultivation may be given. This space can be applied for suggesting references of an opinion in order to make the opinion more reliable.

คุณเอิร์ธ / จำแนกตามส่วนที่ใช้ / กระถัง / พิกุล
สมุนไพรร : พิกุล - *Mimusops elengi* Linn.

ภาพสมุนไพรร | สักขะแห้วไป | ชื่อเรียกสมุนไพรร | ส่วนที่ใช้/สรรพคุณ | ข้อพึงระวัง/พิษ | ข้อมูลเพิ่มเติม | เอกสารอ้างอิง

เสนอความคิดเห็นเกี่ยวกับส่วนที่ใช้และสรรพคุณ โดยคลิก VOTE ในกรณีที่ท่านเห็นด้วยกับส่วนที่ใช้และสรรพคุณนั้น ในกรณีที่ท่านคิดว่ามีส่วนที่ใช้อื่นและ/หรือมีสรรพคุณอื่นให้คลิกไปที่ +เพิ่มส่วนที่ใช้/สรรพคุณ ถ้าไม่สามารถ VOTE หรือไม่ปรากฏเครื่องหมาย + แสดงว่ายังไม่ได้เป็นสมาชิก เชิญสมัครเป็นสมาชิกได้ โดยคลิกไปที่ เชิญสมัครสมาชิกคุณเอิร์ธ

สรรพคุณที่มีการเสนอมา แสดงทั้งหมด (12) | < ย้อนกลับ 1 - 12 สดไป >

VOTE	ส่วนที่ใช้	ประโยชน์	วิธีใช้	คะแนนโหวต
<input checked="" type="checkbox"/>	ดอก	มีกลิ่นหอม จัดอยู่ในพืชกึ่งเถาทั้งห้า เข้ายาหอม ปารุงหัวใจ แก้เจ็บคอ ใช้แต่งกลิ่น เข้ายาเครื่องยาไทย รักษาลมขับเสมหะ ทำให้อุณหภูมิ รสหอม สุขุม แก้ลมปารุงโลหิต		7
<input checked="" type="checkbox"/>	ดอก	ทำเครื่องสำอาง แก้ท้องเสีย		4
<input checked="" type="checkbox"/>	ดอก	แก้ปวดเมื่อยกล้ามเนื้อ	น้ำมันหอมระเหยจากดอก ใช้ทา	1
<input checked="" type="checkbox"/>	ดอก	ปวดหัว เจ็บคอ		1
<input checked="" type="checkbox"/>	เปลือกต้น	มีรสฝาด แก้โรคเหงือกอักเสบ ทำให้ฟันทน แก้ปวดเมื่อย รสฝาด ชั่วแมงกินฟัน (ฟันผุ)	ต้มอมกัวคั่ว	1

Figure 3: Voting the Opinions about Indications

uses the name may be given. For sharing and voting the opinion in a topic, a majority voting is applied. In this version, all members are given equal weight. If users agree with the opinion, a simple click on the button "Vote" will increase the score by one. Each member has only one vote for an opinion. The opinion with higher score will be moved up to upper part of the window. In case of multiple opinions are provided, the popular vote will select a set of preferable terms used in the community. For usages of an herb, This topic may be the most attractive for herbal information. Part-used of the plant, its indications and how its uses, can be given (Figure 6). A list of predefined parts which may be used for treatments is provided. A member may select the part and suggest it indications. The method for preparation

Figure 4: Sharing Additional Information

6.4 Providing Basic Information and References

A user of administrative group gets right for inserting a new herb into the system and also grant right to the other users. General characteristics of a new herb such as description about leaves, flowers, fruit, etc., location, culture are added into the system. Furthermore, references for this information from standard reference sources or additional information from members (which is proved by herbal specialists) can be given for increasing the confidence of data. In Figure 5, a list of references for an herb, is shown.

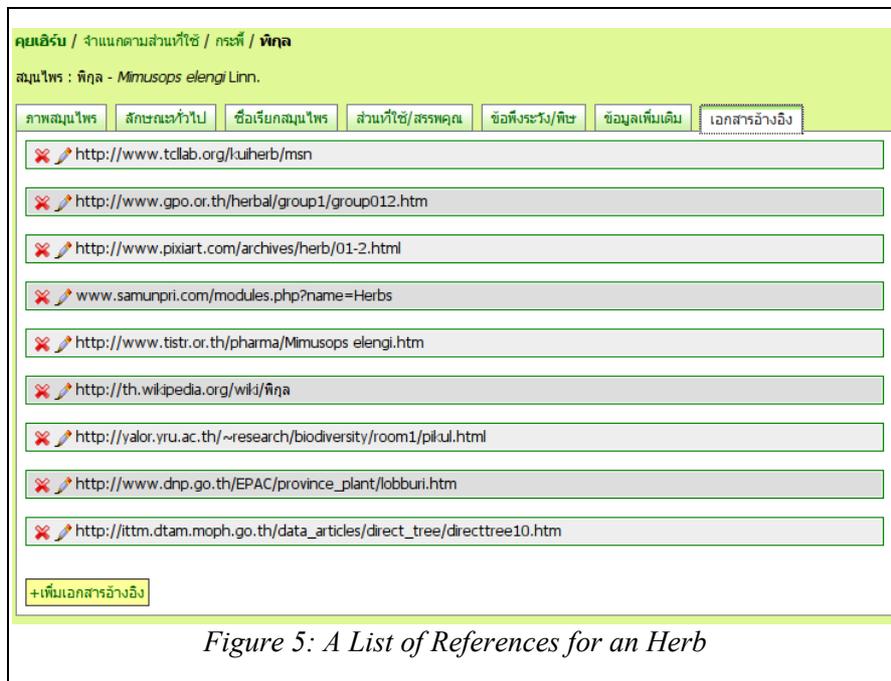


Figure 5: A List of References for an Herb

6.5 Searching Herbal Information

To facilitate users for searching herbal information, the system provides several patterns of searching from herbs' name and family such as Thai common name, Thai local name, English name, scientific name and family. The screen for searching is shown in Figure 6.

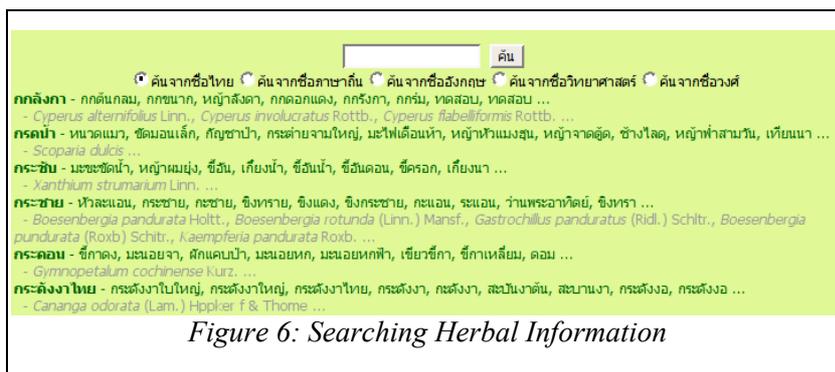


Figure 6: Searching Herbal Information

7. Conclusion and Future Works

In this work, we addressed the problem of collecting herbal information from multicultural community for data mining. To alleviate this problem, the KUIHerb was used as a platform for building a web community for collecting the Thai intercultural herbal knowledge based on Web 2.0 and Web 3.0 concepts. For an herb, a scientific name and its images were used for common understanding. KUIHerb provides a capability in expressing the information about part of herb in usages, indications, methods for preparation, precautions and toxicity. In case of multiple opinions are provided, the

popular vote would select the most preferable term used in the community. From this technique, valuable and reliable data would be selected. Furthermore, a list of experts in traditional medicine could be discovered and could be formed a network for exchanging information. Knowledge collected from the KUIHerb could be applied in herbal information retrieval and data mining system such as text classification, clustering and association rules, which are crucial in the area of ethnopharmacology and modern pharmacology.

In the first version of KUIHerb, majority voting with equal weight from the members were used for selecting the best opinion. However, the member who has made more valuable contribution to the system should be given more weight. Therefore, the weight from members should be different, based on their level of contribution. Furthermore, members may give negative weight to an opinion which they expect that it should be incorrect. Moreover, when data are large enough, several data mining approaches will be performed. These issues are left for our future works.

8. Acknowledgments

This paper is a part of the work supported by the National Electronics and Computer Technology Center (NECTEC) via research grant NT-B-22-MA-17-50-14. We would like to thank to all participants who contribute their knowledge and/or utilize herbal information in KUIHerb.

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