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Article · July 2019

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International Journal of Botany Studies
ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 11-04-2019; Accepted: 15-05-2019
www.botanyjournals.com
Volume 4; Issue 4; July 2019; Page No. 58-59

Edible Canna (*Canna edulis* Ker), A potential crop for Vietnam food industry

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Abstract
Edible canna starch was used to replace rice flour and cassava starch in noodle industry in Vietnam, which aims to enhance product quality. In addition, it also is applied to treat some various diseases in folk medicine and as a source of dietary fiber for food industry. Some studies on phytochemistry and pharmacology were screened. Based on this systematic review, we discussed for future perspectives and suggest that thorough scientific scrutiny is necessary in future researches and development policy implications also were argued.

Keywords: dietary fiber, edible canna, noodle, starch

1. Introduction
High fiber and low glycemic index foods with many several health benefits such as control blood glucose, obesity and digestibility function. Edible canna (*Canna edulis* Ker) is a starchy rhizome crop grown infrequently in the tropical highlands. In Vietnamese, Edible canna called "dong riềng" is cropped in both in mountainous and in some low-lying areas. The rhizome of edible is mostly used for isolating starch which has large granules and high amylose content, and is used for processing transparent starch noodles (miến dong). This noodle is famous food which has excellent eating qualities such as high tensile strength, minor swelling and good transparency and better quality compared with native cassava or sweet potato starch noodles [1]. Moreover, edible canna starch has higher paste clarity compared to others and its noodle is considered as a low glycemic index food chosen to alter rice for obesity and diabetic patient, and diet people. Interestingly, it is claimed that this noodle also helps to reduce blood pressure. This mini review aims to give basic knowledge on benefits of edible canna.

2. Economics
Edible canna is an easy-to-cultivate crop and high yield. It is mostly cropped in Bac Kan province, Viet Nam. The growing areas in this province were estimated to be 1.040 ha with production over 71.000 tons, edible canna starch noodle production over 20.000 tons. 1 kg of edible canna starch noodle traded from 3 US$ (normal quality) to 5 US$ (best quality). Although edible canna is considered as an agriculture food crop to reduce poverty and ensure food security, it also is facing many difficulties and challenges, especially the management of product quality and branding.

3. Phytoconstituents
Total phenol and flavonoid contents were highest in hot extract (42.71 mg GAE/g and 21.92 mg QE/g, respectively [2]. Three phenylpropanoid sucrose esters including 3-*O*-*p*-coumaroyl-6-*O*-feruloyl-β-D-fructofuranosyl 6-*O*-acetyl-α-D-glucopyranoside and 3,6-di-*O*-*p*-coumaroyl-β-D-fructofuranosyl 6-*O*-acetyl-α-D-glucopyranoside, 6-*O*-*p*-coumaroyl-β-D-fructofuranosyl α-D-glucopyranoside, and together with four phenylpropanoids caffeic acid, rosmarinic acid, caffeoyl-4'-hydroxyphenyllactic acid and salvianolic acid were isolated from rhizome of edible canna [3]. In addition, pectins were also isolated and characterized [4].

4. Pharmaceutical and Biological activities
In Vietnam, edible canna is used in Traditional Vietnamese Medicine: leaf was used to clear ulcers and rheumatism and as a diuretic. Rhizome was used as a diuretic and demulcent, and treatment of heart-related disease and acute hepatitis.
Canna edulis rhizome extracts have been viewed to be a source of natural antioxidants as it contains high amount polyphenolic compounds [2]. In another study, DPPH radical scavenging activity has been determined with IC50 of 658 µg/ml fresh weight basis, and maximum NO scavenging activity and hydroxyl radical inhibition activity were observed in bioactive diethyl ether: ethyl acetate (1:1) fraction [5]. Lignin isolated from *Canna edulis* Ker residue exhibited strong inhibition on α-D-glucosidate than acarbose with IC50 of 5.3±0.3 µM, which provides evidence that edible canna can be used for treatment of type 2 diabetes [6].

5. Starch quality and practical application
It is evidenced that edible canna starches can be a complementary starch source to cassava for the starch industry. The starches were characterized by gaint granules (10-80 µm). Canna starches have a higher peak viscosity compared to cassava starch pastes at higher temperature. Pastes of edible canna starch were more stable and their viscosity increased to 1800 BU (Brabender units) when cooled. In addition, gelatininzed pastes of edible canna starches also rapidly formed good gels on cooling [7]. It was suggested that retrograded debranched starch can be added to food products such as white bread, cakes and noodles, to boost their resistant starch content and nutritional and functional properties [8]. Cross-linked edible canna starch could increase tensile strength and elongation of rice

noodles. Total dietary fiber content of noodles made from rice flour increased when rice flour was replaced with retrograded and retrograded debranched starches. The cooked noodle strips also exhibited fewer tendencies to stick together [9].

Using fresh tubers of edible canna as a feedstock for ethanol fermentation may optimize time, energy, water usage, lower process complexity, and hence reduce the production cost [10-12]. One kilogram of canna rhizome can be converted to 120 mL of 75% bioethanol with pure bioethanol (97-98%) after re-distillation and dehydration, which was suggested that canna rhizome is promising for bioethanol feedstock [13] (Dewi *et al*., 2010). Dietary fiber of *Canna edulis* ker by-product is 54.84%. Moreover, by-product has relatively high content of phenolic compounds and a moderate antioxidant capacity. So, it can be applied as both a source of dietary fiber and a functional ingredient for food industry [14, 15].

6. Call for further research and development policy implications

It is believed that edible canna is a promise crop for Vietnam food industry to manufacture noodle, white bread and cakes. However, phytochemical, bioactive mechanism and pharmacokinetic studies on interaction of ingredients with brain, blood pressure, digestive systems, and pathways involved in carbohydrate metabolism balance mechanism are largely lacking, therefore firm evidence for further application is need to study in both *in vitro* and *in vivo* models.

Edible canna is chosen as a main crop in proverty reduction program in northern mountainous regions of Vietnam. There is a need of studies on enviromental impact, technical and ecomomic efficiency of edible canna production. Although edible canna noodles are well-known in Vietnam, the development is not commensurate with its potential. Therefore, we can argue that development and production towards value chain is ideal target in order to create local unique product for each rural area. While, household and cooperatives are facing several hurdles such as marketing, product development and improvement, limited capital and lack of access to financing, capacity building training, limited access to large markets. Government policies should be intended to foster growth of small business sector, which play strategic role to promote and support food companies. Learning detail about one village, one product movement from developmental countries such as Japan, Taiwan is recommended to apply in Vietnam situation.

7. Conclusion

Canna edulis Ker can be a complementary starch source to cassava, rice for the food industry of Vietnam as well as the world. There is need of more attention in research and development product made from this crop.

8. Acknowledgements

Authors would like to thank Department of plant industry, Chinese herbal medicine Laboratory, National Pingtung University of Science and Technology.

9. References

1. Hung PV, Morita N. Physicochemical properties and enzymatic digestibility of starch from edible canna (*Canna edulis*) grown in Vietnam. Carbohydrate Polymers. 2005; 61:314-321.
2. Mishra T, Goyal AK, Middha SK, Sen A. Antioxidative properties of *Canna edulis* Ker Gawler. Indian Journal of Natural Products and Resources. 2011; 2(3):315-321.
3. Yun YS, Satake M, Katsuki S, Kunugi A. Phenylpropanoid derivatives from edible canna, Canna edulis. Phytochemistry. 2004; 65:2167-2171.
4. Zhang J, Wang ZW, Yu WJ, Wu JH. Pectins from *Canna edulis* Ker residue and their physicochemical characterization. Carbohydrate Polymers. 2011; 83:210-216.
5. Mishra T, Das AP, Sen A. Phytochemical Screening and *In-vitro* Antioxidant profiling of Solvent Fractions of *Canna edulis* Ker Gawler. Free Radicals and Antioxidants. 2012; 2(1):13-20.
6. Xie F, Gong S, Zhang W, Wu J, Wang Z. Potential of lignin from *Canna edulis* Ker residue in the inhibition of α-D-glucosidase: Kinetics and interaction mechanism merging with docking simulation. International Journal of Biological Macromolecules. 2017; 95:592-602.
7. Piyachomkwan K, Chotineeranat S, Kijkhunasatian C, Tonwitowat R, Prammance S, Oates C, *et al*. Edible canna (*Canna edulis*) as a complementary starch source to cassava for the starch industry. Industrial Crops and Products. 2002; 16:11-21.
8. Wandee Y, Uttapap D, Puncha-arnon S, Puttanlek C, Rungsardthong V, Wetprasist N. *In vitro* fermentabilities of raw and cooked canna starches and their derivatives. Journal of Functional Foods. 2017; 34:461-469.
9. Wandee Y, Uttapap D, Puncha-arnon S, Puttanlek C, Rungsardthong V, Wetprasit N. Quality assessment of noodles made from blends of rice flour and canna starch. Food chemistry. 2015; 179:85-93.
10. Wu TX, Wang F, Tang QL, Zhu ZH. Arrowroot as a novel substrate for ethanol production by solid state simultaneous saccharification and fermentation. Biomass Bioenergy. 2010; 32(8):1159-1164.
11. Shen Y, Tang QL, Wu TX. Optimization of clear liquid fermentation condition for ethanol production from *Canna edulis* Ker. Journal of Nature and Science. 2010; 2(2):115-119.
12. Huang YH, Jin YL, Fang F, Li YH, Zhang GH, Xiao Y, *et al*. Stimultaneous saccharification and fermentation (SSF) of non-starch polysaccharides and starch from fresh tuber of *Canna edulis* Ker at a high solid content for ethanol production. Biomass and bioenergy. 2013; 52:8-14.
13. Dewi K, Trisunaryanti W, Soetarto ES. Development of bioethanol production from canna (*Canna edulis* Ker.) rhizome. International Conference biology, environment and chemistry IPCBEE, 1 IACSIT Press, Singapore, 2011.
14. Zhang J, Wang ZW, Shi XM. *Canna edulis* Ker By-product: chemical composition and Characteristic of the dietary fiber. Food Science and technology international, 2010; Doi: 10.1177/1082013209353832.
15. Zhang J, Wang ZW. Soluble dietary fiber from *Canna edulis* Ker by –product and its physicochemical properties. Carbohydrate polymers, 2013; 92:289-296.