POTENCY OF *SAUROPUS ANDROGYNUS* LEAVES AS A FEED SUPPLEMENT FOR IMPROVING ANIMAL PRODUCTION: NEW CHALLENGES FOR ENTREPRENEURSHIP

Agik Suprayogi
Department of Physiology and Pharmacology, Faculty of Veterinary Medicine, Bogor Agricultural University (IPB), Jl. Agatis-Kampus IPB Darmaga-Bogor-16610, Indonesia, Phone/Fax: 0062-251-629460, email: asupray@yahoo.com

Sauropus androgynus (L.) Merr. (SA), a member of Euphorbiaceae family, is a leafy shrub found in Malaysia, Indonesia, Vietnam and Southwest China. In Indonesia the leaves are commonly used as vegetable and have potency as a stimulant in mothers breast-feeding. Event as traditional medicines, SA leaves have been produced by an Indonesian pharmaceutical companies bearing tablet, caplet and steeping for human. Otherwise, the similar product in animal production hasn't been produced up to now, whereas many scientific researches have already conducted in livestock production. Many aspects might be involved in the emerging markets and industrialization, however this study just focused on the readiness of the SA leaves as a feed supplement for improving animal production in the scientific animal production studies point of view. Many scientific publications reported regarding the bioactivities, chemical compounds, nutrition, possible toxic effects and pharmaceutical formulation of SA leaves. From the scientific publications were known that SA leaves has potency as a feed supplement in lactating ruminants for enhancing milk yield and its quality. In the poultry production it also could enhance egg production, to shorten age maturity, egg yolk intensity, and reducing fat and cholesterol level. The possible reason of the biological effects is that the active substances in the SA leaves play an important role in lactating ruminants and poultry production. The study showed that SA leaves has a big opportunity to be industrialized as a feed supplement, new product, for improving animal production. Cooperation and interdisciplinary approach have to be encouraged in the emerging markets and industrialization.

Keywords: *Sauropus androgynus*, Livestock, Product, and Industry

INTRODUCTION

Sauropus androgynus (SA), a member of *Euphorbiaceae* family, is a leafy shrub found in Malaysia, Indonesia, Southwest China and Vietnam. This plant is commonly used as a vegetable. For instance in Taiwan, people usually consume this plant as a vegetable at 6 to 303 g/d per person (GER *et al*., 1997). A survey that was carried out in and around Kuala Lumpur, Malaysia on 458 families showed that the average consumption of SA was 180 g/wk per person (BENDER and ISMAIL, 1975).

It is also well known that this plant has some properties as a herb or a medicine for such cases as in body weight, hypertension, hyperlipidemia and constipation control (LAI *et al*., 1996; GER *et al.*, 1997). Usually this knowledge is just based on empirical trials.

In Indonesia, many people believe that this plant supports lactation in human beings. Mothers eat or drink SA leaves and preparations respectively, in order to increase their breast feeding capacity (SOEPARTO, 1994). Even as a traditional medicine, SA-extract tablet has been produced by an Indonesian pharmaceutical companies bearing caplet, tablet and steeping for human. Otherwise, for the improving animal production (dairy cow), there is no veterinary pharmaceutical company, which has tried to produce a pharmaceutical preparation as a feed

supplement from, SA leaves for livestock whereas many scientific researches have already executed in livestock production.

Many aspects might be involved in the emerging markets and industrialization. However this study just focused on the readiness of the SA leaves as a feed supplement for improving animal production in the scientific studies point of view. Many scientific publications reported regarding the bioactivities, chemical compounds, nutrition, possible toxic effects and pharmaceutical preparation of SA leaves. From these publications, potency of SA leaves as a new product (feed supplement) for improving animal production could be indicated.

OBJECTIVES

The objectives of this study are as follows:

1. To show that SA leaves have potency as a feed supplement for improving animal production that denotes new challenges for entrepreneurship.
2. To report a literature review of research progress in the SA field for animal production.
3. To develop continuation of research possibilities in the SA field that based on the product oriented.

POTENCY OF SA LEAVES AS A MILK STIMULANT

Many scientiest worked in the SA field. AGIL (1991) showed that the infusion of a preparation of SA leaves 10 % and 20 % showed a significant increase of milk yield, when this preparation was administered orally to mice. From these results, she presumed that SA leaves might contain a substance with an effect on the milk synthesis similar to steroid hormones, prolactin releasing hormone (PRH), oxytocin, and/or prolactin. This presumption is in accordance to the study of DJOJOSOEBAGIO (1965) who also concluded that SA leaves could contain a substance similar to oxytocin, which causes the myoepithelium of the mammary gland to squeeze milk in the alveoli.

An investigation on the effect of SA leaves aqueous extract at a dose of 500 mg/kg BW a day for 12 days on the glucose metabolism in the mammary gland of lactating goats and on milk yield was published by SUPRAYOGI (1993). This extract was administered directly into the abomasum through an implanted catheter. It indicated that there was an increase in the average milk yield of 21.03 % and of glucose metabolism of the mammary gland of 52.66 %. The enhancement of milk yield was followed by the stability in milk quality.

The investigation on the pharmacological and toxicity effect showed that the 70 % alcohol extract of SA leaves at a dose of 1.89 g/d and ewe by abomasal catheter administration, increased milk yield in lactating goats and this extract did not affect the milk quality. Also this extract did not have any toxic effect (SANTOSO *et al*., 1997).

SUPRAYOGI (2000) reported that SA Powder administration at 7.44 g/d and ewe showed the highest increase in milk yield of 7.75 % than SA extract administration at 1.89 g/d and ewe of only 0.89 % compared to the control group. The enhancement of milk yield in the lactating mammary gland could have been caused by two importance factors as follows:

1. The increase of population of secretory cells and the synthetic activities in the secretory cells. The highest contribution on the enhancement of the population of secretory cells and its synthetic activities occurred on SA Powder administration by 72.84 % and 112.97 %, respectively than SA Extract administration of just 25.93 % and 47.28 %, respectively, compared to the control group (SUPRAYOGI *et al*., 2001_a).

2. On the SA Powder administration also showed the highest contribution on the increase in nutrient supply to the lactating mammary gland (as indicated by total VFAs concentration) by 55.86 % than SA Extract administration of only 20.81 %, compared to the control (SUPRAYOGI *et al*., 2001_b)

Chemical Substances of SA leaves and it's Action

Presumably, the biological effect that occurred is a result from 7 possible major substances contained in the SA leaves, such as:

1. Five substances are from a group of polyunsaturated fatty acids, such as *octadecanoic acids*, *9-eicosyne*, *5,8,11-heptadecatrienoic acid methyl ester*, *9,12,15-octadecatrienoic acid ethyl ester*, and 11,14,17-eicosatrienoic acid methyl ester. Through desaturation or elongation these polyunsaturated fatty acids might be changed to arachidonic acid, di-homo--linolenic acid, and eicosapentaenoic acid. These substances play an important role as precursors in the biosynthesis of eicosanoids (prostaglandin, prostacycline, thromboxane, lipoxins, and leukotrienes) through cyclooxygenase or lipoxygenesis pathways. These eicosanoids can be involved in the reproduction, lactation and other physiological processes.(MURPHY, 1989; MASCIOLI, 1989).
2. One substance is 17-ketosteroid, *androstan-17-one,3-ethyl-3-hydroxy-5 alpha.* This substance is directly involved as a precursor or intermediate step in the biosynthesis of steroid hormones in female, such as progesterone, estradiol, and glucocorticoids (DESPOPOULOS and SILBERNAGL, 1991). The steroid hormones play an important role in the regulation of reproduction, lactation, growth and other physiological processes (LÜLLMAN *et al*., 1993).
3. The last substance is *3,4-dimethyl-2-oxocyclopent-3-enylacetic acid*. The hydrolysis of this substance might produce acetic acid, which play an important role as exogenous acetic acid in the stimulation of microbial metabolism in the rumen liquor by activating the citric acid cycle (CUNNINGHUM, 1997).

These major substances of SA leaves can simultaneously play an important role in the milk synthesis stimulation through two possible actions:

1. **First action**: The SA-leaf active compounds might directly or indirectly modulate, prior to lactogenesis and lactation, hormones such as prolactin (PRL), growth hormone (GH), glucocorticoids, thyroid hormone, prostaglandin, and oxytocin. **Direct action** would occur through the action of prostaglandin and steroid hormones (glucocorticoids, progesterone, and estradiol) obtained from eicosanoids and steroid hormone biosynthesis, respectively. These hormones directly stimulate the synthesis of DNA and RNA in the lactating mammary secretory cells (SHIU and FRIESEN, 1980; GANONG, 1993). **Indirect action** could occur through the relatively high level of these hormones in the blood stream, which indirectly stimulate anterior and posterior pituitary gland cells to release PRL, GH, and oxytocin which act directly on the mammary gland. Other hormones such as ACTH, TSH, FSH, LH first stimulate the adrenal cortex, thyroid gland, and ovary gland to release glucocorticoids, triiodothyronine, thyroxine, progesterone, and estradiol, involved in the milk synthesis in the mammary gland (TUCKER, 1985; DESPOPOULOS and SILBERNAGL, 1991).
2. **The second action** might occur through the existence of mediators such as exogenous succinate, malonic acid, acetate, and glutamate. These substances act as the metabolites of hydrolysis processes in the rumen environment from SA leaf active compounds such as *3,4-dimethyl-2-oxocyclopent-3-enylacetic acid* and *monomethyl succinate*, *phenylmalonic acid*, *cyclopentanol,2-methyl-acetate*, and *methylpyroglutame* (AGUSTA *et al*., 1997). These exogenous substrates can participate in rumen fermentative processes to produce VFAs by stimulating the metabolic activities and microbial growth. The possible mechanism of the stimulation might be through participation some important metabolic pathways, such as the

citric acid cycle, rumen microbial protein synthesis, and cross-feeding of intermediates. Exogenous succinate and acetate can participate in the citric acid cycle in the microbial cells to produce ATP.

POTENCY OF SA LEAVES FOR POULTRY PRODUCTION

So far, publication according to the use of SA leaves for Poultry production is still scarce. SANTOSO and SARTINI (2001) reported that 30 g supplementation of SA meal to the broiler diet was effective to improve feed conversion ratio without reducing body weight, besides the supplementation could reduce fat accumulation in broiler chickens. The supplementation also reduced feed intake, It was caused by antipalatability effects of saponin, alkaloid and tannin that might be mediated in part by a neurological effect.

PILLIANG *et al*. (2001) reported that effects of SA meal supplementation by 9 % in the diet to the local pullets revealed that age maturity of chicken to be faster (26 weeks) than supplementation by 6 %, 3 % and 0 % that matured at 27, 27, and 31 weeks of age respectively. Besides, the egg yolk intensity was highest when the hens were given by 9 % SA meal and followed by group of hens given 6 %, 3 %, and 0%. The egg yolk color score were 12, 6, 3 and 1.5 respectively. The cholesterol level in the carcass of hens fed with 9 %, 6 %, 3 %, and 0 % of SA meal were 0.099, 0.100, 0.122, and 0.166 mg %.

Up to now, there is no detail information regarding to the action of the chemical substances in the SA leaves to the reduction of fat accumulation in Broiler, age maturity, egg yolk intensity, and cholesterol level in the carcass.

OPPORTUNITY AND CHALLENGING FOR INDUSTRIALIZATION

In the scientific point of view, there is big opportunity to produce new product from SA leaves as a feed supplement in the industrial scale. The opportunity is still widely opened in the improving animal production, because modern human life-stile tends to consume high quality of food (meat, egg, milk, etc) to maintain their health. Public issue said that consuming food from livestock production usually related to the fat or cholesterol consuming and it causes cardiovascular diseases (hypertension, obesity, Stroke, Coroner Heart Diseases). Therefore, Low cholesterol products (meat, egg, milk, etc) are in great demand. Product from SA leaves could be offered as a feed supplement to improve animal production. In dairy cow, the product could enhance milk yield and its quality. Besides, in the poultry production it also could enhance egg production, shorting age maturity, egg yolk intensity, and reducing fat and cholesterol level in egg or meat.

Many aspects might be involved in the emerging markets and industrialization, its not only in the scientific point of view but also in others sides for examples: Social-Economic, Marketing, Permission, Intellectual Property Rights, etc. All these aspects denote new challenges for industrialization that have to be studied and established before developing an industry.

CONCLUSION

The study revealed that SA leaves has potency as a feed supplement in lactating ruminants for enhancing milk yield and its quality in the poultry production it also could enhance egg

production, shorting age maturity, egg yolk intensity, and reducing fat and cholesterol level in egg or meat.

The possible reason of the biological effects is that the active substances in the SA leaves play an important role in lactating ruminants and poultry production.

The study showed that SA leaves has a big opportunity to be industrialized as a feed supplement, new product, for improving animal production. Besides, many aspects, for examples: Social-Economic, Marketing, Permission, Intellectual Property Rights, etc. denote new challenges for industrialization that have to be studied and established before developing an industry.

Cooperation and interdisciplinary approach have to be encouraged in the emerging markets and industrialization.

REFERENCES

AGIL, M.. 1991. Pengaruh pemberian infus daun katuk *(Sauropus androgynus)* terhadap aktivitas enzim SGPT, SGOT dan SGGT tikusputih betina. Fakultas farmasi Universitas Airlangga. Surabaya. Indonesia.

AGUSTA, A., M. HARAPINI, dan CHAIRUL. 1997. Analisa kandungan kimia ekstrak daun katuk *(Sauropus androgynus* (L.) Merr.*)* dengan GCMS. Warta Tumbuhan Obat Indonesia (The Journal on Indonesia Medicinal Plants), ISSN: 0853-6929, 3(3):31-34.

BENDER, A.E., and K.S. ISMAIL. 1975. Nutritive values and toxicity of a Malaysian food, *Sauropus albicans*. Plant Foods Man, 1:139-143.

CUNNINGHUM, J.G.. 1997. Textbook of Veterinary Physiology, 2nd Edition, pp.331-341. W.B. Sounders Company, Philadelphia-London-Toronto-Montreal-Sydney-Tokyo.

DESPOPOULOS, A. and S. SILBERNAGL. 1991. Color Atlas of Physiology 4thed, pp. 258-271. Georg Thieme Verlag Stuttgart, New York.

DJOJOSOEBAGIO, S. 1965. Pengaruh *Sauropus androgynus* (L.) Merr. terhadap fungsi fisiologis dan produksi air susu. Makalah dalam Seminar National Penggalian Sumber Alam Indonesia Untuk Farmasi. Jogjakarta.

GER, L.P., A.A. CHIANG, R.S. LAI, S.M. CHEN, and C.J. TSENG. 1997. Association of *Sauropus androgynus* and *Bronchiolitis obliterans* syndrome: A Hospital-based Case-Control Study. American Journal of Epidemiology, 145(9):842-849.

LAI, R.S., A.A. CHIANG, M.T. WU, J.S. WANG, N.S. LAI, J.Y. LU, and L.P. GER. 1996. Outbreak of bronchiolitis obliterans associated with consumption of *Sauropus androgynus* in Taiwan. Lancet, 348:83-85.

LÜLLMAN, H., K. MOHR, A. ZIEGLER, and D. BIEGER. Color Atlas of Pharmacology, pp. 70-77, 250-251, 230-240. Georg Thieme Verlag Stuttgart, Thieme Medical Publishers, Inc. New York.

MASCIOLI, E.A.. 1989. Nutrition, pp. 169-182. *In* Editors: WATKINS, W.D., M.B. PETERSON, and J.R. FLETCHER. Prostaglandins in Clinical Practice. Reven Press, Ltd., New York. USA.

MURPHY, R.C.. 1989. Biosynthesis and Metabolism, pp. 1-20. *In* Editors: WATKINS, W.D., M.B. PETERSON, and J.R. FLETCHER. Raven Press, New York. USA.

PILIANG, W.G., A. SUPRAYOGI, N. KUSUMORINI, M. HASANAH, S. YULIANI, and RISFAHERI. 2001. Efek pemberian daun katuk (Sauropus androgynus) dalam ransum terhadap kandungan kolesterol karkas dan telur ayam lokal. Laporan Akhir Penelitian-LP-IPB, Proyek ARMP II. Bogor-Indonesia.

SANTOSO, S.O., M. HASANAH, S. YULIANI, A. SETIAWATI, Y. MARIANA, T. HANDOKO, RISFAHERI, AGGRAENI, A. SUPRAYOGI, N. KUSUMORINI, dan W. WINARNO. 1997. Production of a medicine product from Katuk`s leaves *[Sauropus androgynus* Merr*]* to increase the secretion and quality of breast milk. Integrated Priorities Research (Riset Unggulan Terpadu II). Indonesia.

SANTOSO, U. and SARTINI. 2001. Reduction of fat accumulation in broiler chickens by *Sauropus androgynus* (Katuk) leaf meal supplementation. Asian-Aust. J. Anim. Sci. 14(3):346-350.

SHIU, R.P.C., and H.G. FRIESEN. 1980. Mechanism of action of prolactin in the control of mammary gland function. Annu. Rev. Physiol., 42:83.

SOEPARTO, S. 1994. Jamu Jawa Asli. Pustaka Sinar Harapan, Jakarta,.

SUPRAYOGI, A.. 1993. Meningkatkan produksi susu kambing melalui daun katuk (*Sauropus androgynus* (L.) Merr.). Agrotek, 1(2) September 1993:61-62.

SUPRAYOGI, A.. 2000. Studies on the biological effects of *Sauropus androgynus* (L.) Merr.: Effects on milk production and the possibilities of induced pulmonary disorder in lactating sheep. ISBN:3-89712-941-8, Cuvillier Verlag Göttingen, Germany.

SUPRAYOGI, A., U. TER MEULEN, T. UNGERER, and W. MANALU. 2001_a. Population of secretory cells and synthetic activities in mammary gland of lactating sheep after consuming *Sauropus androgynus (L.) Merr.* leaves. Indon. J. Trop. Agric. 10(1):1-3.

SUPRAYOGI, A. 2001_b. The influence of *Sauropus androgynus* leaves on the blood serum volatile fatty acids concentration in lactating sheep. Proceeding of International Symposium-Cum-Workshop:“ Resource Management: Public-Private and Knowladge Sharing“, ISBN:979-95902-9-9, pp:155-161. SEARCA-LosBanos-Philippines.

TUCKER, H.A. 1985. Endocrine and neural control of the mammary gland, pp.39-76. In Editor: LARSON, B.L. Lactation. The Iowa State University Press/Ames.