VIRTUTIS INCUNABULA

Vol. 08, No. 1 (2021)

The Efficacy of Ipil-Ipil Pods *Leucaena Leococephala* as Anthelmintic to Native Pigs

Robin Leo B. Desusa[1], John MIchael F. Cabuguason[1], and Ma. Corazon Acaba[1]

[1] College of Arts and Sciences, University of Negros Occidental-Recoletos, Incorporated, Bacolod City, Philippines

ABSTRACT

Commercial dewormers have been a great help to the farmers in addressing the pig's internal parasitic problem. Farmers tend to forget organic and safe practices in minimizing internal parasites. Thus, this experimental research has been conducted to determine the effects of Ipil-Ipil pods as dewormers on native pigs. Ipil-Ipil *(Leucaena Leococephala*) is a small tree that grows throughout the Philippines, and its leaves and seeds are consumed for its anthelmintic properties. Sixteen native pigs were grouped into four and penned at the city veterinary farm in Victorias City. The pigs were then treated with four quantities (in grams) of Ipil-Ipil pods. The data (fecal) samples were collected and later examined using fecalysis. Based on the results, internal parasitic eggs present in the intestines of the native pigs were minimized, and according to the data gathered, 100 grams of Ipil-Ipil pods have shown significant value in their application on the native pigs. The researcher also found that the volume intake of ipil-ipil seeds does not differ in the effectivity of removing the parasite eggs from the intestinal tract, making Ipil-Ipil an excellent natural antihelmintic supplement for native pigs. Ipil-Ipil pods are recommended as organic dewormers for native pigs.

Keywords

dewormers, Ipil-Ipil pods, native pigs, internal parasites, treatments, experimental research, Philippines

INTRODUCTION

Ipil-Ipil, scientifically known as *Leucaena Leococeophala*, is a small tree growing in low to medium altitudes throughout the Philippines. Leococeophala was derived from 'leu,' meaning white, and 'Cephala,' meaning head, refers to the flower. Ipil-Ipil plant is considered one of the fastest-growing leguminous trees in the Philippines (Stuart, Jr., 2018). It has an acrid, sweet, bitter, and mildly toxic taste. In addition, Alam et al. (2005) claimed that the Ipil-Ipil had been known and used in farms and even marginal land plantations because of its multi-use production and wide range of ecological amplitude. Moreover, its seeds possess chemopreventive, anti-proliferative, anthelmintic, antidiabetic, and antibacterial properties. Ipil-Ipil also helps remove internal parasites (Heuze & Tran, 2015).

Ipil-ipil is a tropical tree that originated in Mexico and escaped as a weed in warm and tropical countries. It is used as a hedge tree, green manure, and forage crops for animals. Its timber is used as a raw material

in biofuel mixed with conventional fuel. (Myer & Walker, 1999; Meena Devi et al., 2013).

Over time, more studies about Ipil-Ipil have been conducted, and it has been found that humans can benefit from it. In some provinces here in the Philippines, Ipil-Ipil is often used as a coffee substitute. Its leaves and seeds are eaten raw as an anthelmintic for little children. Also, when the seed is roasted, it can be used as an emollient to soothe the skin.

The province of Negros Occidental, which is a benchmark location for livestock production in the country, is promoting small-scale pig raisers to use Negros Black Pigs for their business due to its budget-friendly characteristics. These animals are straightforward to raise. These types of pigs can grow fast and reproduce five to eight piglets, even under adverse and unfavorable conditions (The Visayan Daily Star, 2019).

According to the Philippine Information Agency (2019), the population of native black pigs in the province of Negros Occidental is around 20,000 heads. Moreover, the demand for native black pigs is increasing since these pigs were also delivered to other provinces, specifically to Iloilo and Cebu.

Also, to further promote Negros Occidental as one of the leading organic provinces in the country, the local government units in the region that are raising Negros Occidental black pigs are also pushing the farmers to use herbal plants such as Ipil-Ipil pods as a dewormer. Ipil-Ipil tree is considered to be an ethnobotanical plant through the use of its pods (SunStar, 2019).

Based on a study by Ozaraga and Ozaraga (2017) regarding the use of Ipil-Ipil as a dewormer for Darag native chicken, the results showed that ethnobotanical plants like Ipil-Ipil are more effective when fed within a higher dosage compared to the dosages.

In this study, the Ipil-Ipil pods were used to determine what dosage is more effective when fed as anthelmintic to Negros Occidental black pigs being raised by farmers in Victorias City, Negros Occidental. Furthermore, this study focused on the percent reduction of eggs per gram (EPG) count found in the feces of Negros Occidental black pigs.

Ozaraga and Ozaraga (2017) concluded that Ipil-Ipil, betel nut, and papaya seeds were found to have the same comparable percent reduction in EPG count as the commercial dewormer. All seeds needed are available in the market every day, thus how abundant and available the materials used for dewormers are. Despite the availability of these seeds, farmers still choose to be more reliant on synthetic solutions.

Hale (2006), stated that no dewormer has a hundred percent effect on the host animal. Intense parasites will thrive and breed stronger parasites if a dewormer does not eliminate them. Furthermore, frequent deworming or unscheduled deworming also gradually weakens the effect of dewormers. Different practices on deworming are a must to ensure the safety and health of the animals. Over time, more studies are being conducted, and new discoveries on dewormers are being introduced in the world as the battle for a healthy and safe way of living is still ongoing (Roepstorff et al., 2011).

On the other hand, de Almeida (2018) stated that in the tropics, animals such as cattle, goats, and other farm animals play a significant role in humans. Some of these crucial roles are consumption, transportation, and fiber, as well as fuel. To this extent, health and management are a top priority for those people who are raising animals. Parasites are ever-present in the tropics, as well as in other places. Therefore, proper management and medication play an essential role in such animals.

Waller et al. (2001) stated that evidence on the effectiveness of plant-based dewormer is unsure due to little available scientific publications. This strongly indicates that people are more focused on finding more effective synthetic solutions rather than natural remedies, thus, causing people to be unaware of how

some plants can serve as solutions on problems that people pay for more.

According to Delgado et al. (2012), there is no significant difference between seed and leaf extract on the adult motility test. However, there is a difference in seed and leaf extract concentration on the egg hatch test. Meanwhile, Stuart Jr., (2018) stated that the extract of the Ipil-ipil seed contains chemopreventive, anti-proliferative, antihelmintic, antidiabetic, and antibacterial properties. These properties can help the growth, health, and production of animals that are consuming the seed extract.

Burke et al. (2009), concluded in their study that herbal dewormers remain unproven on livestock. This means that it yielded no measurable health benefits that indicate that the herbal dewormer failed to control the GIN (Gastrointestinal nematode) in sheep. This gives us more reasons to study possible ways of improving natural remedies to help address the parasitic problems that our farmers are facing.

According to Shih et al. (1999), the body weight of the pigs that were dewormed with the mixture of synthetic and mineral dewormers was significantly higher than that of the pig samples that were untreated with dewormers. Nissen et al. (2011) stated that the usage of anthelmintic on swine significantly reduces the infestation of worms, especially on piglets. In regards to the statement, we must apply dewormers on our pigs for healthy and profitable production.

Stear et al. (2006) stated that livestock, which is affected by nematodes, are currently relying on anthelmintic, but these animals are threatened by the widespread evolution of the drug-resistant parasites population. This still occurs even though several anthelmintic practices are being observed, including grazing management.

According to Williams and Rothlisberger (2012), deworming should be a priority when a farmer first receives the pigs and should follow the instructions indicated on the dewormers. This is done in order to avoid the infestation of the parasites and the worms on the pig. By doing so, this will result in healthier pigs and, thus, give the farmers a good return of investment in their business.

According to Van Meensel et al. (2006), deworming should be necessarily repeated as the eggs of the parasites and worms are persistent and will survive in the environment for years. Deworming resists the nematodes that are present in the feeds, and these are going to be prevented from further reproducing. Countries from all over the globe have stated in agricultural studies the high prevalence of gastrointestinal parasites in pigs produced mainly in intensive systems and industrial farms. In a study conducted by Belœil et al. (2003), prigs from five intensive production pig farms were detected with Trichuris suis and strongyles. Meanwhile, Weng et al. (2005) conducted 3636 fecal samples from pigs reared on farms with an intensive production system in Guangdong Province, China, which showed that there were coccidia (24.9%), T. suis (5.7%), Ascaris suum (5.2%), and strongyles (2.5%) present, which are common parasites. The infections, such as that of Ascaris suum, according to Van Krimpen et al. (2010), are controlled with the use of synthetic drugs. However, organic farmers still prefer non-pharmaceutical treatment for the worms that are infesting their pigs. Therefore, phytotherapy was used on different herbs, and the results were carefully matched with the synthetic drug. Thus, we can say that the organic way of farming, in this case, deworming, is recommendable because we can ensure that there will be fewer side effects on the pigs treated with natural medicine rather than the synthetic method.

Organic practice in farming does not only concentrate on the anthelmintic but also on other aspects such as the improvement of nutrition, health, and genetic on the animal. Whereas, in the synthetic dewormers can cause more harm to the animals

Vol. 08, No. 1 (2021)

which are being treated with it (Fetene & Amante, 2019).

According to Han et al. (2001), the proper combination of feed management and a clean environment is a significant help for healthy and profitable production of swine. Dutto and Petrosillo (2013) also stated that the infestation of parasites is due to the feed that the pigs are consuming. Ha also added that the small wounds, caused by biting and sharp objects inside the pig pens, also enable parasites to infest on the pigs.

Roesel et al. (2016) stated that due to poor biosecurity, an internal parasitic infestation could occur, especially on the piglets. He also added that poor sanitation is one of the factors that can cause an internal parasite to lay eggs on pigs, as pigs could eat their manure. Improper husbandry is also a factor that causes internal parasites to infest the pigs, which can lead to losses and economic downfall for farmers (Aiyedun & Oludairo, 2016).

Internal parasites, according to the study by Kouam et al. (2018), are one of the top factors that limit or hinder the success of sustainable livestock production. Harper (2004) stated that, internal parasites must maximize the use of all the nutrients from the host to multiply and survive. They are normally found in the digestive tract of the swine. Internal parasites are commonly acquired by the food that the pigs eat and in their dirty surroundings, like pig pens. This tells us that we must be more cautious about how we manage our pigs and their sanitation. The feed that we serve to them must be handled very carefully and meticulously because, until today, some farmers are still using "swill" to be fed on their pigs, which results in unhealthy feeds and thus, unhealthy pigs, which can also negatively affect the health of the humans that consume them (Schembri et al., 2010).

According to the Department of Primary Industries (2017), internal parasites affect the performance of pigs, especially the young ones. Besides the fact that internal parasites have the capacity to kill these pigs, the most common results of parasitism are the following: reduced daily rate of gain, loss of appetite, meager feed conversion, and vulnerability to other pathogens. However, the performance effect varies, depending on pig breed, nutrition, species of parasite, geographic location, type of housing, and management. The growth and health of pigs are greatly affected by the infestation of various internal parasites in their bodies. We, as agriculturists, must find a more suitable, healthy, and organic solution to solve this problem and share it with the farmers who are in the pig industry (McKellar & Jackson, 2004).

According to Tiwari et al. (2009), despite the use of synthetic dewormer, the internal parasites present in the pigs were still a problem for the farmers. Anthelmintic resistance is one of the causes of the internal parasites still thriving in their host.

Internal parasites rob the pigs of their nutrients for growth and fattening, resulting in a small income for pig producers. Malnutrition, due to loss of appetite, is one of the main reasons why the pig industry is suffering from a significant economic loss. There should be awareness among swine producers regarding the common internal parasites of swine and methods used to control and prevent these problems. In terms of removing parasites surrounding the pigs, sanitation, and disease prevention are significant factors. According to Coles (2002), without a change in anthelmintic use, there is the likelihood of increasing numbers of cases for which no anthelmintic is effective, and animal welfare may be compromised. Proper deworming is also a key factor in ensuring the safety and good health of the pigs. Deworming must be done at least once a month to remove the internal parasite and its eggs.

Papaya, Boldo leaf, and Artemisia, according to Van Krimpen et al. (2008), are not an alternative replacement for conventional treatment of Ascaris suum. A combination of thorough cleaning and

proper management of pig pens and commercialized deworming are still the best solutions for removing Ascaris suum from pigs. Feed additives are essential to an animal that lacks certain nutrients. The feed additive can supply the lacking nutrients, add certain kinds of nutrients that help promote growth, and make the animal healthy. Richert and DeRouchey (2010) conducted a review of how feed additives can affect our pigs in terms of growth, health, and production. The handbook showed that feed additives are non-nutritive compounds added to swine diets to enhance animal performance. The major ones used in swine diets are antibiotics, chemotherapeutics, anthelmintic, probiotics, organic acids, and copper sulfate. Some organic feed additives include betel nut, papaya, and Ipil-Ipil as they contain high nutrition that the animals can positively benefit from. Anti-oxidants are often included in feeds that are high in fat. They help to prevent the feed from quickly becoming rancid. Proper use and volume must be observed when applying feed additives to pigs as they contain high nutrients, which can also be harmful to them. Producers should seek professional help to develop a specific feed additive program to maximize returns and not damage the pigs.

In their study, Ozaraga and Barrios (2014) identified commercial and synthetic dewormers as expensive and less desirable for human consumption. It has been found that the pigs treated with commercial and synthetic dewormers had meats that are full of chemicals that are hazardous to humans. Ipil-Ipil seeds and betel nuts were used to determine the efficacy of organic dewormers against the native chicken. The results of their study show that Ipil-Ipil seeds, which were powdered, had a significant effect on the removal of roundworms in native chicken, as well as betel nut was also effective in removing roundworms in the digestive system of native chicken. With this study, we can say that the use of organic dewormers is economically better than the use of synthetic dewormers. Synthetic dewormers have the same effect as natural dewormers but cost more and can bring more harm to chickens than good. On the other hand, organic dewormers are far safer, more secure, and more desirable for buyers who buy them. This clearly says that we must promote organic farming and further educate and encourage people about the importance and benefits of organic agriculture.

METHODOLOGY

The researcher utilized the quantitative research design as the appropriate method for this study in identifying the efficacy of Ipil-Ipil pods as anthelmintic for native pigs on the Victorias City Veterinary Office farm. Sixteen native pigs from Victorias City, Office of the City Agriculture, were used during the duration of this study. The said swine, aged 5 to 6 months, underwent screening to ensure roundworms infected them. They were confined in pens with an area of 3x5 square feet, deliberately constructed as preparation for the testing. Each pig had a pig pen of its own. The construction of pig pens utilized materials such as bamboo sticks, nails, and metal wire. Moreover, materials that were used for this study, besides those used in the construction of pig pens, were Ipil-Ipil pods, Agogo wrappers, bamboo sticks, ice buckets, Fenbendazole, and rice mash.

The treatments and replications were laid out in a randomized complete block design (RCBD), which is an investigational design in which the experimental material is distributed into blocks or groups of experimental units that have the same characteristics. Each group or block contains a complete set of treatments that are assigned at random to the experimental units.

This study focused on investigating four treatments, each with four replications. The volume of treatments was divided into four in order to analyze the possible effect of the removal of internal parasitic eggs in the

native pigs. For the treatment, mature and freshly picked Ipil-Ipil pods were collected on the demo farm of Victorias City and were mixed with rice bran. The mixture was then fed to the swine, wherein varying amounts were given; 50g was allotted for treatment 2, 100g for treatment 3, and 150g for treatment 4. Meanwhile, treatment one was fed with powdered 500g Fenbendazole, which was used as a control, mixed with rice bran, as it acts as the controlled variable in this study. Fenbendazole is an anti-worm drug effective against mature and immature forms of common worms that infect pigs.

The researcher collected the fecal matter of every pig using a bamboo stick and placed it inside the Agogo wrapper, specifically a plastic wrapper, which is 6"x10" in size. After packing (airlock), the fecal samples were placed in the ice bucket to preserve the internal parasite eggs present in the fecal samples. Moreover, this is to preserve the samples and avoid contamination that may affect the results. The accumulated fecal matter was transported to Bacolod City and brought to the Regional Animal Disease Diagnostic Laboratory in Iloilo City the following day. The samples were brought to the RADDL for fecalysis, wherein they will be analyzed in the laboratory to find the presence of worms and their eggs.

The interval of the application of treatments was eight days and 14 days during the ration of feeds to the pigs to monitor the effectiveness of the Ipil-Ipil pods as anthelmintic for native pigs using their feces. Force-feeding was applied so that the exact volume of Ipil-Ipil pods could be accurately fed to the native pigs. This process involved plainly forcing the pigs to eat the Ipil-Ipil pods by grabbing their nose and insistently putting the plants inside their mouths for them to feed on them.

RESULTS, DISCUSSION, AND IMPLICATIONS

The statistical tool ANOVA hypothesis test or the analysis of variance was used, wherein the results showed the mean of the number of parasite eggs that were present in the feces of the native pigs applied with different treatments and day intervals. The findings revealed that three of the four treatments tested indicated the use of Ipil-Ipil pods as an effective antihelmintic to native pigs. This is because the results showed that after feeding the pigs with the said plant, the number of internal parasites had dropped 8 and 14 days after application. The analysis of variance of the number of parasites present in the feces of native pigs for eight days after the application of Ipil-Ipil pods revealed significant results, wherein Treatment 4 had the most significant result. Meanwhile, the results of the ANOVA showed no significant results using the laboratory data of the collected feces of the native pigs 14 days after the application of Ipil-Ipil pods. The following table shows the summary of the internal parasites that were present in the native pigs after feeding them with Ipil-Ipil pods.

The results of the study revealed that Ipil-Ipil pods had a very positive antihelmintic effect. Treatments 1, 3, and 4 showed excellent positive responses to the removal of the internal parasite eggs. Also, findings showed that the volume intake does not matter in terms of the effectiveness of removing the parasite eggs from the intestinal tract of the pigs, which makes the Ipil-Ipil an excellent natural antihelmintic supplement for native pigs. The effectiveness of Ipil-Ipil as a natural antihelmintic was evaluated based on the reduction of internal parasites in the findings of the fecalysis.

The results in this study showed that before the application of the Ipil-Ipil pods, the native pig used in Treatment 2 had the most number of parasite eggs present in its feces, with a mean of 2, 925 internal parasite eggs, followed by the native pig used in Treatment 4 with a mean of 1, 087 internal parasite eggs, and the native pig used in Treatment 1 with a mean of 650 internal parasite eggs. Meanwhile, the

native pig used in Treatment 3 showed no internal parasite eggs in its feces.

The results revealed that treatment 4 had the most internal parasite eggs present in the feces, with a mean of 667.25, followed by treatment 2, with 392.75 internal parasite eggs present. Treatment 1 has a mean number of 150 parasite eggs. Among all the results, treatment 3 has the lowest number of internal parasite eggs present, with a mean of 38.75.

The results showed that treatment 2 had the most internal parasite eggs present in the pigs' feces, with a mean of 713.50. This was followed by treatment 4, with a mean of 100 parasite eggs. According to the laboratory examination, both treatments 1 and 3 had zero parasite eggs present in the feces.

Findings also revealed that the prevalence of Ascaris suum, strongyles, coccidia, and Trichurus suis among the pigs verifies the statement of Belœil et al. (2003) and Weng et al. (2005) that these nematodes are common among pigs across the globe. Based on the clinical laboratory report issued by the Regional Animal Disease Diagnostic Laboratory, almost all of the native pigs used in this study have shown the presence of these nematodes.

If the coefficient of variation (CV) is high, it indicates a high chance of experimental error. Moreover, it shows the extent of variability of data in a sample concerning the mean of the population. The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different.

As seen in Table 1, the CV before applying Ipil-Ipil pods and 14 days after its application showed a high CV. This means that the differences seen are not much of the inherent characteristics of the treatments but more of the external factors. These external factors are not within the researcher's control at any acceptable level. Meanwhile, Pr stands for probability, wherein it refers to the likelihood that an event will occur. It is calculated by dividing the number of favorable outcomes by the total number of possible outcomes. In this study, Pr is illustrated as not significant (ns) before the application of Ipil-Ipil pods and 14 days after its application.

The results that were gathered showed an effect on the removal of parasite eggs in the fecal samples of the native pigs. The first application treatment, wherein the data were gathered after eight days of the application of the Ipil-ipil pods, showed a significant value in lowering the count of internal parasite eggs present on the fecal samples of the native pigs. The second treatment resulted in treatments 1 and 3

Table 1
Summary of Means of Internal Parasites Eggs Present After Applications of Ipil-ipil pods as Anthelmintic for Mative Pigs

Treatment	Number of Parasites Eggs		
	Before Application	8 Days After Application	14 Days After Applications
T1 (control)	650.00	150.00	1.25
T2 (50g)	2,925.00	392.75	713.50
T3 (100g)	0.00	38.75	0.75
T4 (150g)	1,087.50	667.25	25.00
Pr	Ns	*	Ns
CV	56.06%	31.25%	110.76%

having no parasite eggs on the fecal samples, whereas treatment 2 showed the presence of parasite eggs on one of the fecal samples of the native pigs. This can also be explained by the study of Burke et al. (2009), as some animals have developed immunity upon the application of anthelmintics to their bodies.

CONCLUSION AND RECOMMENDATIONS

The control of infections in pigs caused by internal parasites has always been an economic burden, especially for those who are in the agricultural business sector. This study proved that Ipil-Ipil could be used as an anthelmintic to reduce internal parasites in native pigs. Therefore, we can safely say that the application of Ipil-ipil pods to native pigs has a positive effect on the removal of internal parasites.

Moreover, it can be considered a healthier, safer, and inexpensive alternative to commercial anthelmintics. Because Ipil-Ipil is natural and organic, which does not presumably possess any harmful substances, it is healthier and safer for us compared to synthetic ones, thus increasing the farmer's profit. One tablet of Fenbendazole (500g) or other anthelmintics costs Php 20-60. The use of Ipil-Ipil pods as a dewormer for native pigs is economically feasible to farmers, as the plant is abundantly available on almost every side of the country throughout the year. Unlike commercial drugs, Ipil-Ipil pods are natural and inexpensive because they can be found and grown on one's farm or even in one's backyard.

This can help not just the Negrosanon farmers to progress, but also to inspire farmers in other provinces and promote the organic way of farming practice here in the Philippines. This proves that the use of natural anthelmintics are cost-effective and can really help in boosting business. Moreover, by using these natural resources, we may be able to promote sustainable livelihood in our province, and hopefully, in our country.

Based on the overall outcome of the study, it is strongly suggested that further studies regarding the Ipil-Ipil as an anthelmintic should be conducted to broaden and verify the findings of this study. Moreover, the researcher recommends utilizing the findings as a springboard for the formulation of other studies related to Ipil-Ipil and to further widen the study of Ipil-Ipil as an anthelmintic. Also, it is strongly suggested that future studies be conducted regarding alternative organic anthelmintic plants to reduce internal parasites in pigs and other livestock.

Furthermore, in future similar studies and experiments to be performed, it is recommended that three applications of the Ipil-ipil pods must be made to gain accurate results and safeguard the consistency of the findings, which denotes credibility.

It is also strongly suggested that the pigs must be weighed before and after the application of Ipil-ipil pods to the native pigs to gather data and to examine the animal accurately and could be a possible variable that may be measured in order to know if there is a significant difference between the pigs and their weight. In addition, it is suggested that Ipil-ipil pods as an anthelmintic for farmers who raise native pigs must be promoted as it has a similar effect as synthetic dewormers. The use and promotion of natural anthelmintics, such as Ipil-Ipil, should be given attention. In line with this, the Department of Agriculture and other agricultural organizations may organize an agricultural awareness campaign.

REFERENCES

Aiyedun, J. O., & Oladapo, O. O. (2016). Prevalence of intestinal parasitism of swine in a north central state of Nigeria. *Journal of Advanced Veterinary and Animal Research, 3*(3), 278-281. http://doi.org/10.5455/javar.2016.c163

Alam, M. A., Matin, M. A., Hoque, M. M., & Hoque, A. T. M. R. (2005). Seed morphology and germination

of ipil-ipil (leocaena leococephala (lam.) De wit.) Under different conditions at nursery stage in bangladesh. *Asian Journal of Plant Sciences*, *4*(2), 98–101. https://doi.org/10.3923/ajps.2005.98.101

Belœil, P., Chauvin, C., Fablet, C., Jolly, J., Eveno, E., Madec, F., & Reperant, J. (2003). Helminth control practices and infections in growing pigs in France. *Livestock Production Science*, *81*(1), 99–104. https://doi.org/10.1016/s0301-6226(02)00192-6

Burke, J., Wells, A., Casey, P., & Kaplan, R. (2009). Herbal dewormer fails to control gastrointestinal nematodes in goats. *Veterinary Parasitology*, *160*(1–2), 168–170. https://doi.org/10.1016/j.vetpar.2008.10.080

Coles, G. C. (2002). Sustainable use of anthelmintics in grazing animals. *Veterinary Record*, *151*(6), 165–169. https://doi.org/10.1136/vr.151.6.165

de Almeida A. M. (2018). Improving animal production and health in the tropics-the challenge of humankind. *Tropical animal health and production*, *50*(6), 1177–1179. https://doi.org/10.1007/s11250-018-1647-y

Delgado, B., Lacsamana, E.G., Macatangay, R.S., Marquez, B.L., Miranda, F.R., Reyes, R.B., & Cabanela, R.A. (2012). Antihelminthic activity of leucaena glauca (ipil-ipil) seed and leaf extract in an ascaridae model. *The Steth, 6,* 53-64. https://research.lpubatangas.edu.ph/wp-content/uploads/2014/10/STETH-6.5.pdf

Department of Primary Industries. (2017). *Internal parasites of pigs*. New South Wales Government. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/433018/Internal-parasites-of-pigs.pdf

Dutto, M., & Petrosillo, N. (2013). Hybrid ascaris suum/lumbricoides (ascarididae) infestation in a pig farmer: a rare case of zoonotic ascariasis. *Central European Journal of Public Health*, *21*(4), 224–226. https://doi.org/10.21101/cejph.a3798

Fetene, A., & Amante, M. (2019). Alternative to synthetic anthelminthic to prevent and control gastro intestinal parasite in sheep and goat. *American-Eurasian Journal of Scientific Research 14* (1), 06-14. https://doi.org/10.5829/idosi.aejsr.2019.06.14

Hale, M. (2006). *Managing internal parasites in sheep and goats.* ATTRA - National Sustainable Agriculture Information Service. http://www.omgp.org/uploads/1/5/0/6/15064894/parasitesheep-111006174618-phpapp011.pdf

Han, I. K., Lee, J. H., Piao, X. S., & Li, D. (2001). Feeding and management system to reduce environmental pollution in swine production - review -. *Asian-Australasian Journal of Animal Sciences*, *14*(3), 432–444. https://doi.org/10.5713/ajas.2001.432

Harper, A. (2004, December). *Internal parasite control in pigs.* Virginia Cooperative Extension. https://sites.ext.vt.edu/newsletter-archive/livestock/aps-04_12/aps-391.html

Heuze, V., & Tran, G. (2015, September 9). *Leucaena (leucaena leucocephala)*. Feedipedia. https://www.feedipedia.org/node/282

Kouam, M. K., Ngueguim, F. D., & Kantzoura, V. (2018). Internal parasites of pigs and worm control practices in Bamboutos, western highlands of Cameroon. *Journal of Parasitology Research*, *2018*, 1–10. https://doi.org/10.1155/2018/8242486

McKellar, Q. A., & Jackson, F. (2004). Veterinary anthelmintics: old and new. *Trends in Parasitology*, *20*(10), 456–461. https://doi.org/10.1016/j.pt.2004.08.002

Myer, R. O. & Walker, W. R. (1999). *Controlling internal parasites in swine* [Fact sheet]. University of Florida. https://mysrf.org/pdf/pdf_swine/s12.pdf

Meena Devi, V. N., Ariharan, V. N., & Nagendra Prasad, P. (2013). Nutritive value and potential uses of leucaena leucocephala as biofuel – a mini review. *Research Journal of Pharmaceutical Biological and Chemical Sciences 4*(1), 515-521. http://www.rjpbcs.com/pdf/2013_4(1)/%5B55%5D.pdf

Nissen, S., Poulsen, I. H., Nejsum, P., Olsen, A., Roepstorff,

A., Rubaire-Akiiki, C., & Thamsborg, S. M. (2011). Prevalence of gastrointestinal nematodes in growing pigs in Kabale District in Uganda. *Tropical animal health and production*, *43*(3), 567–572. https://doi.org/10.1007/s11250-010-9732-x

Ozaraga, M. I., & Barrios, M. B. (2014). Ethnobotanical anthelmintics for free range native chickens. *CAPSU Research Journal, 26*(1). http://researchjournal.capsu.edu.ph/index.php/crj2014/article/view/13

Ozaraga, M. I. & Ozaraga, B. P. (2017). Efficacy of ipil-ipil (leucaena leucocephala), betel nut (areca catechu) and papaya (carica papaya) seeds against roundworms of darag native chicken. *Philippine Journal of Veterinary and Animal Sciences, 43*(1). https://ejournals.ph/article.php?id=11467

Philippine Information Agency. (2019, August 9). Kalinga state u holds yookah fiesta. *Philippine Times*. https://www.philippinetimes.com/news/262012288/kalinga-state-u-holds-yookah-fiesta

Richert, B.T., & DeRouchey, J.M. (2010). Feed additives for swine national swine nutrition guide. *Agricultural and Food Sciences.* https://www.semanticscholar.org/paper/Feed-Additives-for-Swine-National-Swine-Nutrition-Richert-DeRouchey/6c40d3fec64cea3cca6a4990e1938681ba6a0830

Roepstorff, A., Mejer, H., Nejsum, P., & Thamsborg, S. M. (2011). Helminth parasites in pigs: new challenges in pig production and current research highlights. *Veterinary parasitology*, *180*(1-2), 72–81. https://doi.org/10.1016/j.vetpar.2011.05.029

Roesel, K., Dohoo, I., Baumann, M., Dione, M., Grace, D., & Clausen, P. (2016). Prevalence and risk factors for gastrointestinal parasites in small-scale pig enterprises in Central and Eastern Uganda. *Parasitology Research*, *116*(1), 335–345. https://doi.org/10.1007/s00436-016-5296-7

Schembri, N., Hernández-Jover, M., Toribio, J., & Holyoake, P. (2010). Feeding of prohibited substances (swill) to pigs in Australia. *Australian Veterinary Journal*, *88*(8), 294–300. https://doi.org/10.1111/j.1751-0813.2010.00604.x

Shih, I.-L., Tsai, H., Jiang, W.-J., Huang, Y.-T., & Koh, T.-J. (1999). Effects of a synthetic growth hormone-releasing peptide on growth and carcass traits of pigs. *The Journal of Agricultural Science*, *132*(3), 347–350. https://doi.org/10.1017/s0021859699006437

Stear, M. J., Doligalska, M., & Donskow-Schmelter, K. (2006). Alternatives to anthelmintics for the control of nematodes in livestock. *Parasitology*, *134*(2), 139–151. https://doi.org/10.1017/s0031182006001557

Stuart, G., Jr. (2018, March). *Ipil-ipil, Leucaena Glauca, Santa Elena, Yin He Huan: Herbal Therapy / Alternative Medicine in the Philippines*. StuartXchange. https://www.stuartxchange.org/Ipil-ipil.html

SunStar. (2019, March 28). Black pig production pushed in NEGOCC. *SunStar Publishing Inc.* https://www.sunstar.com.ph/bacolod/business/black-pig-production-pushed-in-negocc

The Visayan Daily Star. (2019, March 28). Invest in black pig production. *This* [Image attached] [Status update]. Facebook. https://web.facebook.com/visayandailystar/photos/a.10150625380820632/10161467829570632/?type=3&_rdc=1&_rdr#

Tiwari, K., Chikweto, A., Belot, G., Vanpee, G., Deallie, C., Stratton, G., & Sharma, R. (2009). Prevalence of intestinal parasites in pigs in grenada, west indies. *West Indian Veterinary Journal, 9*(1), 22-27. https://www.researchgate.net/publication/234118231_Prevalence_of_intestinal_parasites_in_pigs_in_Grenada_West_Indies

Van Krimpen, M. M., Binnendijk, G. P., Borgsteede, F. H. M., & Gaasenbeek, C. P.H. (2008). *Effect of some herbs as alternative for conventional treatment of Ascaris suum in pigs*. Wageningen University

Research. https://library.wur.nl/WebQuery/wurpubs/reports/371349

Van Krimpen, M. M., Binnendijk, G. P., Borgsteede, F. H. M., & Gaasenbeek, C. P.H. (2010). Anthelmintic effects of phytogenic feed additives in Ascaris suum inoculated pigs. *Veterinary Parasitology*, *168*(3–4), 269–277. https://doi.org/10.1016/j.vetpar.2009.11.004

Van Meensel, J., Lauwers, L., Pyckhout, H., Kanora, A., & Goossens, L. (2006). Impact of strategic deworming in pig production on profitability and nutrient efficiency. *Mortality*, *27*(1.02), 22-84. https://www.ivis.org/library/ipvs/ipvs-biennial-international-congress-denmark-2006/impact-of-strategic-deworming-pig

Waller, P., Bernes, G., Thamsborg, S., Sukura, A., Richter, S., Ingebrigtsen, K., & Höglund, J. (2001). Plants as De-Worming Agents of Livestock in the Nordic Countries: Historical perspective, popular beliefs and Prospects for the future. *Acta Veterinaria Scandinavica, 42*(1). https://doi.org/10.1186/1751-0147-42-31

Weng, Y. B., Hu, Y. J., Li, Y., Li, B. S., Lin, R. Q., Xie, D. H., Gasser, R. B., & Zhu, X. Q. (2005). Survey of intestinal parasites in pigs from intensive farms in Guangdong Province, People's Republic of China. *Veterinary parasitology*, *127*(3-4), 333–336. https://doi.org/10.1016/j.vetpar.2004.09.030

Williams, S. & Rothlisberger, D. (2012). *Project pig production planner.* Utah State University Cooperative Extension. https://extension.usu.edu/utah/4h/files/ProjectPigProductionPlanner.pdf