Experimental poisoning in broiler chickens by *Senecio vernonioides*, *Senecio conyzaefolius* and *Senecio paulensis*

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ABSTRACT.- Biffi C.P., Savaris T., Parizoto L.H., Ogliari D., Boreli V., Emmerich T., Gardner D. & Gava A. 2018. Experimental poisoning in broiler chickens by *Senecio vernonioides*, *Senecio conyzaefolius* and *Senecio paulensis*. Pesquisa Veterinária Brasileira 38(11):2065-2069. Laboratório de Patologia Animal, Centro de Ciências Agroveterinárias, Universidade do Estado de Santa Catarina, Av. Luiz de Camões 2090, Conta Dinheiro, Lages, SC 88520-000, Brazil. E-mail: aldo.gava@udesc.br

Plants of the genus *Senecio* sp. are known to produce hepatic lesions in different animal species, including man. To evaluate the toxicity of three species of *Senecio* found in regions where cattle are bred in the state of Santa Catarina, experiments were conducted on broiler chickens (*Gallus domesticus*). Green leaves of *S. conyzaefolius*, *S. vernonioides* and *S. paulensis* were collected and dried in the shade. After drying, the leaves were ground, mixed into the feed and fed to the chickens divided into 3 groups. Group 1 and Group 2 received single doses of 5g/kg and 20g/kg, respectively. Group 3 was given daily doses of 1g/kg for 20 days (values corresponding to green plant) and Group 4 (control) received free feed of the plant. For each group, five chickens were submitted to necropsy at 30 days and five to 60 days after planting, and five chickens that consumed *S. vernonioides* and *S. conyzaefolius* at the dose of 1g/kg for 20 days were necropsied at 90 days after the beginning of the experiment. Macroscopic lesions were observed in chickens that consumed *S. vernonioides* at a dose of 1 g/kg for 20 days in birds necropsied at 30, 60 and 90 days and were characterized mainly by liver of firm consistency, diminished in size with yellowish coloration and evident lobular pattern, ascites and hydropericardium. In microscopy the main lesions observed were megalocytosis, hepatocyte swelling, fibrosis and biliary hyperplasia and were more intense at the dosage of 1 g/kg for 20 days for *S. vernonioides* and less severe in the chickens that ingested *S. conyzaefolius*. The chickens that received *S. paulensis* showed no macroscopic and microscopic lesions.


RESUMO.- [Intoxicação experimental em frangos de corte por *Senecio vernonioides*, *Senecio conyzaefolius* e *Senecio paulensis*] As plantas do gênero *Senecio* sp. são conhecidas por produzirem lesões hepáticas em diferentes espécies de animais, inclusive no homem. Para avaliar a toxicidade de três espécies de *Senecio* encontradas em regiões onde são criados bovinos no estado de Santa Catarina, foram conduzidos experimentos em frangos de corte (*Gallus domesticus*). Folhas verdes de *S. conyzaefolius*, *S. vernonioides* e *S. paulensis* foram coletadas e secadas a sombra. Após a secagem, as folhas foram trituradas, misturadas na ração e fornecidas aos frangos divididos em 3 grupos. O Grupo 1 e o Grupo 2 receberam doses únicas de 5g/kg e 20g/kg, respectivamente. O Grupo 3 foi fornecida doses diárias de 1g/kg por 20 dias (valores corresponde a planta verde) e o Grupo 4 (Controle) recebeu ração livre da planta. Para cada grupo, cinco frangos foram necropsiados a 30, 60 e 90 dias e cinco frangos que consumiram *S. vernonioides* e *S. conyzaefolius* por 20 dias foram necropsiados aos 90 dias.

Macroscopicamente, as lesões observadas em frangos que consumiram *S. vernonioides* a dose de 1g/kg por 20 dias foram caracterizadas principalmente por massa hepática de consistência firme, reduzida em tamanho com coloração amarelo-claro e padrão lobulado evidente, ascite e hidropéridium. Na microscopia, as principais lesões observadas foram megalocitose, edema de hepatócitos, fibrose e hiperplasia biliar e mais intensas na dosagem de 1g/kg por 20 dias para *S. vernonioides* e menos severas no frango que consumiu *S. conyzaefolius*. Os frangos que receberam *S. paulensis* não apresentaram lesões macroscópicas e microscópicas.

INDEX TERMS: Plantes toxiques, poule de bresse, intoxication, *Senecio conyzaefolius*, *S. vernonioides*, *S. paulensis*.
were subvided into lots of 10 chickens per species, groups of 35 birds were used. For the experiment, 110 one-day-old chicks of the Coob lineage were housed in experimental aviary located in the Poultry Sector of the Agroveterinary Sciences Center of the State University of Santa Catarina (CAV-UDESC). Birds were kept in boxes where they received feed and water ad libitum. For the S. vernonioides and S. conyzaefolius species, groups of 35 birds were subvided into lots of 10 chickens for single doses of 5g/kg/LW and 20g/kg/LW and of 15 birds for the dose of 1g/kg/LW for twenty days. For the S. paulensis species, 10 birds were used for each dose evaluated. In total, 100 chickens received Senecio in the feed plus control group with 10 birds.

From the 12 days of age, the groups of birds received the different types of Senecio mixed in the feed, except for the Control group that received only feed. The formation of groups, as well as the Senecio species tested and their respective doses are shown in Table 1. During the experiment, birds were daily inspected and behavior and feed consumption were evaluated. Weekly, birds from Groups 1, 2 and Control were weighted. For Group 3, weighing was performed twice a week, during the first 20 days to readjust the daily Senecio dose to the increasing weight of birds.

For euthanasia, the cervical dislocation method, approved by Normative 1000 of the Federal Veterinary Medicine Council (CFMV) and by the ethics committee of animal experimentation of CAV-UDESC (Protocol 01.07.14) was used. All birds were necropsied to observe lesions and central nervous system, heart, kidney and liver samples were collected, which were fixed in 10% buffered formalin, routinely processed and stained with hematoxylin and eosin (HE). Selected sections were stained by Mason’s trichrome histochemistry technique for the detection of fibrous connective tissue. Material processing and histological analysis were performed at the Laboratory of Animal Pathology of CAV-UDESC.

Samples of collected plants were sent to the Department of Botany of the State University of Santa Catarina for identification and classification. Dry plants were sent to USDA, ARS, Poisonous Plant Research Laboratory, Logan, Utah, USA, for analysis and quantification of pyrrolizidine alkaloid doses.

RESULTS

Analysis of APs of Senecio spp. samples used in this study revealed the presence of toxic alkaloids dehydrate pyrrolizidine ester (DHPA) and their quantification was performed with the dry weight of samples. Senecio vernonioides presented dose of 19,599μg/g, S. conyzaefolius 2,500μg/g and S. paulensis...
157μg/g. For the three *Senecio* species tested, no clinical changes were observed.

For each group formed, five chickens were submitted to necropsy at 30 days and five at 60 days after the onset of plant consumption, five chickens that consumed *Senecio vernonioides* and *S. conyzaefolius* at the dose of 1g/kg for 20 days were also necropsied at 90 days after the start of the experiment. Necropsy showed lesions only in *S. vernonioides* poisoning, which are described in Table 2. The main macroscopic alterations occurred in the liver and were characterized by decreased size, firm consistency and whitish striations and/or reddish spots on the surface (Fig.1).

Microscopically, hepatic lesions were observed that varied from mild to severe in birds that received *S. vernonioides* (Table 3) and were demonstrated in Figure 2 and mild or absent in birds that received *S. conyzaefolius* (Table 4). In birds that received *S. paulensis*, no significant histological lesions were observed.

<table>
<thead>
<tr>
<th>Lesion</th>
<th>30 days</th>
<th>60 days</th>
<th>90 days</th>
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</thead>
<tbody>
<tr>
<td>Ascite</td>
<td>1/5</td>
<td>1/5</td>
<td>1/5</td>
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<tr>
<td>Hydropericardium</td>
<td>1/5</td>
<td>3/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Gallbladder with increased volume</td>
<td>-</td>
<td>1/5</td>
<td>-</td>
</tr>
<tr>
<td>Hepatic atrophy</td>
<td>2/5</td>
<td>3/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Liver with evident lobular pattern</td>
<td>1/5</td>
<td>2/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Yellowish liver</td>
<td>1/5</td>
<td>2/5</td>
<td>0/5</td>
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Fig.1. Livers of chicken from Group 3 (1g/kg for 20 days) necropsied at (A) 60 days and (B) 90 days after onset of the consumption of *Senecio vernonioides*. (A) Liver reduced in size and with reddish spots and (B) with whitish striations.

Fig.2. Histology of the liver of one of chickens from Group 3 (1g/kg for 20 days) necropsied 90 days after the onset of consumption of *Senecio vernonioides*. (A) Megalocytosis and fibrosis, which dissect the hepatocyte cords. HE, obj.40x. (B) Fibrous connective tissue. Masson’s trichomic histochemistry staining, obj.40x.
Macroscopic lesions characterized by ascites, hydropericardium, yellowish liver, firm consistency, evident lobular pattern and decreased size were observed at necropsy of chickens that received Senecio vernonioides at dose of 1g/kg for 20 days and are compatible with those reported by Méndez et al. (1990) in experimental poisoning with S. brasiliensis, Senecio heterotrichius and S. cisplatinus. In addition to birds, these lesions are also described in cattle (Tokarnia & Döbereiner 1984, Méndez et al. 1987, Barros et al. 1989), horses (Gava & Barros 1997, Pilati & Barros 2007) and sheep (Ilha et al. 2001, Schild et al. 2007, Grecco et al. 2011). The occurrence of lesions in other organs such as CNS (central nervous system) in cattle (Tokarnia & Döbereiner 1984, Méndez et al. 1987, 1990, Barros et al. 1987a), horses (Gava & Barros 1997, Pilati & Barros 2007) and sheep (Ilha et al. 2001, Grecco et al. 2011) was not observed in this study. These data are in agreement with Cheeke & Pierson-Goeger (1983) and Méndez et al. (1990).

S. conyzaefolius and S. paulensis species did not develop macroscopic lesions at the dose and consumption periods evaluated. This may be related to the time chickens consumed the plant and the PA concentration. In experiments performed by Méndez et al. (1990) with other Senecio species, birds received the plant for a longer period of time (60 consecutive days) and according to Tokarnia & Döbereiner (1984), lesions caused by PAs are progressive. Another factor involved could be the variation in the number of PAs present in these species when compared to S. vernonioides, which presented DPHA dose of 19,599μg/g, with S. conyzaefolius presenting 2,500μg/g and S. paulensis 157μg/g. Stigger et al. (2014) observed macroscopic lesions in bovines naturally poisoned by S. madagascariensis with PA doses of 500μg/g, lower than that found in S. conyzaefolius. The appearance of these lesions could be related to the period and amount of plant consumed, because in that case, animals were food restricted.

Lesions were also experimentally observed in birds and cattle that consumed different Senecio species with PA doses ranging from 50 to 3,100μg/g (Méndez et al. 1990). A small individual variation in the intensity of lesions within the same Senecio species evaluated was observed. This demonstrates the individual susceptibility to PAs (Hooper 1978). The administration of single and high doses is responsible for causing acute manifestations of the disease, with clinical signs and death of cattle (Tokarnia & Döbereiner 1984, Méndez et al. 1987, Riet-Correa et al. 2007). In this experiment, it was not possible to observe this result. A similar description is made by Tokarnia et al. (1990), with single S. desiderabilis doses of 20 and 40g/kg also failed to reproduce the acute disease, but with smaller and continuous doses, two cattle died. However, acute manifestation was experimentally demonstrated by Tokarnia & Döbereiner (1984) with a single S. brasiliensis dose of 20g/kg to a bovine that developed clinical symptoms and death 20 days after ingestion. Pilati & Barros (2007) also provided a single S. brasiliensis dose of 15g/kg to an equine that demonstrated neurological symptoms. Grecco et al. (2012) provided S. brasiliensis at a single dose of 60g/kg to sheep that showed no clinical signs or microscopic changes, demonstrating the resistance of this species to the single dose of the plant.

Regarding the dosages tested, the most evident lesions were at dose of 1g/kg for 20 consecutive days. Small doses over an extended period produced more significant lesions than high and single doses. This result corroborates Tokarnia & Döbereiner (1984) and Riet-Correa et al. (2007), who described lesions caused by PAs as progressive and irreversible. This progressive effect described by the authors may explain the lack of manifestations of clinical signs and death. However, the lesions found indicate liver function impairment, suggesting that if these animals remained alive, they could develop more serious lesions with the appearance of clinical signs and mortality. Histological lesions ranged from mild to moderate megalocytosis, fibrosis, biliary proliferation and hepatocyte swelling, and lesions were most evident in necropsied birds at 60 and 90 days after plant consumption, corroborating Tokarnia & Döbereiner (1984) and Riet Correa et al. (2007). Méndez et al. (1990) describe, megalocytosis lesions,
disorganization of the hepatic parenchyma, proliferation of biliary epithelium, necrosis for birds that consumed the plant for a period of 60 days and proliferation of connective tissue into the parenchyma from Glisson’s capsule for birds experimentally poisoned by *S. heterotrichius*.

Regarding the single doses administered, the dose of 20g/kg was more toxic than the dose of 5g/kg, but this difference was not significant, as well as variations in lesion intensity among *Senecio* species. However, lesions were more significant in the necropsied chickens 60 days after plant consumption, which again proves the relationship between the period after plant consumption and the development of lesions (Tokarnia & Döbereiner 1984, Riet-Correa et al. 2007).

*S. vernonioides* and *S. conyzaefolius* species are possible sources of poisoning for cattle, as they have demonstrated toxic effect on broilers and are present in the in the Highland and Midwestern regions of the State of Santa Catarina.

**CONCLUSIONS**

*Senecio vernonioides* and *S. conyzaefolius* were toxic to chickens and morphological lesions varied according to the dose tested and PA concentration.

*Senecio paullensis* did not demonstrate toxicity to broilers at the doses tested.

**REFERENCES**


