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RESEARCH ARTICLE

Livestock Poisoning Plants: Identification and its Veterinary Importance in Afar Region of Ethiopia

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Abstract:

Background:

Plants are the major source of feed and have vital nutritious importance to animals; however, they also comprise a large variety of poisons known.

Objective:

A study was conducted to identify potential poisonous plants to domestic animals and its veterinary importance in selected districts of Afar region, Northeast Ethiopia.

Methodology:

Questionnaire survey and key informants interview were done with a total of 245 respondents and plant samples were taken for identification.

Results:

A total of 21 plants were identified and documented to have a poisonous effect on livestock. The poisonous plants frequently complained by the respondents were *Capparis tomentosa*, *Prosopis juliflora*, *Parthenium hysterophorus*, *Lantana camara*, *Acacia absynica*, *Sorghum bicolor*, *Datura stramonium*, *Plantago lanceolata*, *Pteridium aquilinum* and *Solanum incanum*. The majorly described predisposing factors for the occurrence of plant poisoning were feed shortage, nutritional deficiency and excessive consumption. The common poisoning seasons indicated were at the end of rainy season and during drought time. The plant parts that caused poisoning were leaves of plants. This study also revealed that bloating and other GIT disturbances, salivation, bloody urine and inappetence were among the frequently manifested signs in poisoned livestock. Moreover, this study showed that caprine and ovine followed by camels and bovine were the most frequently poisoned animals.

Conclusion:

Phytotoxicity is commonly occurring and challenging health of livestock in the study area. Hence, proper range management should be practiced to decrease the danger of plant poisoning to animals and all concerned bodies should collaborate on pasture and water development programs to minimize the risk of enforced consumption of livestock on poisonous plants due to feed shortage.

Keywords : Animal Feed, Bovine, Camel, Caprine, Phytotoxicity, Livestock.

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1. INTRODUCTION

Plants are the major source of feed for herbivorous animals and also used for the treatment of many diseases. Moreover, plants have vital nutritious importance to animals and providing the normal atmospheric oxygen. As animals majorly feed on plants and these plants comprise a large variety of poisons known [1], poisoning in animals consuming these plants is

inevitable. Poisonous plants produce their toxic effects after being ingested and/or absorbed by animals, which include physical upset, loss of productivity and death. A variety of poisonous plants have caused extensive losses to the livestock industry in many parts of the world mainly east Africa including Ethiopia [2].

The possibility of founding poisonous plants in hay and forage poses a serious risk to livestock and other animals. There are several contributing factors, which facilitate the occurrence of animal poisoning. Different sensitive species of animals can ingest or exposed to a poisonous plant at normal

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conditions. It is also more likely to occur in animals which have been moved from one part of the country to another. Sudden onset of disease in a group of animals is the most obvious case among the many indications of plant poisonings [3].

Factors such as route of absorption, dose, physical and chemical nature of the poison, frequency of exposure, species, body size, sex, and general health status of the animal may influence the action of poisonous substances. In addition, chemical factors such as particle size, solubility, toxicity, absorption and excretion rate, affinity for body tissues or fluids, interaction with other drugs, and lacking development of metabolic pathway can have an impact on its occurrence. Liver or kidney insufficiency may enhance toxicity due to poor metabolism or slow excretion of toxicants. Alteration in gastrointestinal pH can change the ionization of drug or chemicals and influence their absorption; presence or absence of food in the stomach affects the toxicity of certain compounds [4].

Plant poisoning of livestock can be diagnosed based on history, clinical syndrome observed, post mortem lesions, evidence of plant grazing and/or browsing, and remains of poisonous plants in the gastro intestinal tract. If poison principle of the poisonous plants is known, confirmatory laboratory tests can be done [5]. Good pasture management such as keeping the desirable forage species productive throughout the grazing season reduces the possibility of animals grazing on poisonous plants. In this case, most poisonous weeds and cultivated plants can be controlled. It may be practical to simply fence off infested areas so that animals do not have access to particularly hazardous weeds. This is one of the most important steps in preventing animal suffering or loss from poisonous plants. Other alternative methods of controlling poisonous weeds are to spray them with approved herbicides and physically or mechanically remove the poisonous plants [6].

Poisonous plants affecting both large and small animals are a major concern for the practicing veterinarian and livestock producer in every country. In countries with higher plant biodiversity, the problem of plant poisoning to livestock may be greater. Plant biodiversity in Ethiopia is very high, as there are about 7,000 species of vascular plants in which some of it could be poisonous [7].

Plant poisoning in livestock can occur due to either accidental ingestion along with grass or obstinate consumption. Animals can consume poisonous plants when pasture is dry while most poisonous plants remain green all throughout the year [1]. Newly imported or animals migrated from other areas could be at higher risk because they are unfamiliar with the strange ingestion of their fresh surrounding [8].

Overgrazing of pastures and ranges probably the greatest factor in causing losses from poisonous plants. The danger of overgrazing is always greatly increased in periods of moisture deficiencies that reduce forage production. However, plant poisoning essentially is a local problem occurring in areas where poisonous plants may form a large proportion of the herbage species available to grazing animals. Poisonous plants

are often naturally refused by animals due to their repulsive smell or irritant juices and are eaten only when other herbage pastures is scarce [9]. Some plants may have the potential to penetrate skin of animals and introduce a poisonous chemical and causes an immediate burning sensation of the skin [10].

Among the factors that expose the livestock to the poisonous plants; shortage of feed, nutritional deficiency and sudden exposure were the major problems [1, 9]. Feed shortage can force animals to browse perennial shrubs and bushes while most of these perennial plants have been known to contain toxic secondary metabolites [5]. These plant poisoning cause health problems in livestock with huge economic loss to the pastoralists due to production loss, morbidity and mortality of their animals. Furthermore, it is not customary among local veterinarians to write plant poisoning case reports, thus most of the plant poisonings that occur in the pastoral areas of Ethiopia are not well documented in the literature. Hence, it is imperative to bring the attention of professionals to the effects of poisonous plants on animal health and productivity [11]. Therefore, this study was conducted to fill this gap by identifying the potential poisonous plants to domestic animals and its veterinary importance in selected districts of Afar region, Northeast Ethiopia.

2. MATERIALS AND METHODS

2.1. Study Areas

Afar regional state is located in the Great Rift Valley, comprising semi-arid range land in northeastern Ethiopia. According to regional estimates, the livestock population of Afar is about 10.12 million. The livestock populations found in the region are 2,318,220 cattle, 2,499,640 sheep, 4,444,290 goats and 859,580 camels. The Afar Regional State has five administrative zones, which are further subdivided into 32 districts. Pastoralism and agro-pastoralism are the two major livelihood ways practiced in the region. The population of the region is estimated to be about 1.4 million of which 90% are pastoralists and 10% agro-pastoral. The altitude of the region ranges from 120m below sea level to 1500m above sea level. Temperatures vary from 20C in higher elevations to 48C in lower elevations. Rainfall is bi-modal throughout the region with a mean annual rainfall below 500 mm in the semi-arid western escarpments and decreasing to 150 mm in the arid zones to the east [12]. The study was conducted in three districts selected from three zones, namely: Asayita district of Awsi resu zone, Aba'ala district of Kilebeti resu zone and Gewanie district of Gebi resu zone.

2.2. Target Population for the Study

The target populations for this study were livestock owners (herders and traditional healers) and animal health practitioners.

2.3. Study Design and Sampling Methods

The study design was cross-sectional type. Regarding sampling, three zones from the region and one district each from three zones were selected purposively based on expected plant coverage. Pastoralist Association (PA) was the lowest

administrative unit within the district that was considered during the study. Accordingly, four PAs from each district were conveniently selected based on variety plant coverage and availability of traditional healers and individuals with good experience and knowledge of plant poisoning. All volunteer traditional healers selected based on recommendation from elders and other concerned bodies, and herders and animal health practitioners with good knowledge of plant poisoning were considered for the study. A total of 245 individuals were interviewed for the questionnaire survey and among these 35 individuals were used for the plant collection and identification based on their knowledge and interest to participate in the study.

2.4. Data Collection

2.4.1. Questionnaire Survey

Questionnaire survey was carried out by interviewing 245 voluntary animal owners, traditional animal healers and animal health practitioners. The questionnaire was used to collect information related to types of livestock poisoning due to poisonous plants; local name of poisonous plants; poisonous parts of the plant (seed, bark, leaves, etc), poisonous growth stage and state of poisoning; seasons of abundance of the poisonous plant; ways of exposure, amount to cause poisoning, and poisonous effects produced on exposure; agro-ecological and habitat of the poisonous plant and species of livestock mostly affected from the poisoning.

2.4.2. Key Informants Interview

From the total 245 individuals, an in-depth interview was conducted with 35 traditional healers and animal health practitioners in each selected districts who has helped in collecting and identifying the poisonous plants from the field in the region. The selection of these key informants was based on their knowledge and experience in the issue with the help of administrators, veterinarians and elders in the areas.

2.4.3. Sample Collection

Appropriate sample of plant parts was collected from surrounding rangeland of study areas with the key informants who knows the local name of the plants. The samples collected from the rangeland were compressed and preserved in laboratory according to Queensland Herbarium plant specimen

collection and preserving manual [13] and Biology department of Samara University was contacted for taxonomic identification.

2.5. Data Management and Analysis

The information that was gathered through questionnaire survey on suspected and complained poisonous plants to livestock was coded and entered to Microsoft Excel 2007 spread sheet. SPSS version 20 was used for the analysis. Descriptive statistics was used to calculate frequency and the percentage of the respondents.

3. RESULTS

In the present study, from the total respondents (245), about 70.2% (172) of the interviewee were livestock owners and 15.5% (38) and 14.3% (35) were animal health practitioners and traditional healers, respectively. The majorly described predisposing factors for the occurrence of plant poisoning were feed shortage, nutritional deficiency and excessive consumption. The common poisoning seasons indicated were at the end of rainy season (August to September) and during drought time (February to May) but at the beginning of the rainy Season (June to July) was low (Table 1).

According to the present study, a total of 21 plants were identified and documented to have a poisonous effect on livestock. The poisonous plants frequently complained by the respondents were *Capparis tomentosa*, *Prosopis juliflora*, *Parthenium hysterophorus*, *Lantana camara*, *Acacia absynica*, *Sorghum bicolor*, *Datura stramonium*, *Plantago lanceolata*, Grass species, Bracken fern (*Pteridium aquilinum*) and *Solanum incanum* (Figs. 1-8). The major plant parts that caused poisoning were leaves. This study also revealed that bloating and other GIT disturbances, salivation, bloody urine and inappetence were among the frequently manifested signs by poisoned livestock. Moreover, this study showed that caprine and bovine followed by camels and ovine were the most frequently poisoned animals (Table 2).

The poisonous plants with higher botanical frequency complained by respondents were *Capparis tomentosa* (156) and *Prosopis juliflora* (133). The clinical sign with leading veterinary frequency was bloating. Moreover, majority of the poisonous plants mainly occur at the rainy season and causes poisoning after repeated exposure (Table 3).

Table 1. Summary of responses on risk factors associated with plant poisoning.

Variables	No. of Respondents	Percentage (%)*
Common poisoning season		
Beginning of rainy season	89	36.3
End of rainy season	245	100
Drought time	213	86.9
Source of poisoning plants		
Wild	234	95.5
Domestic	56	22.8
Both	85	34.7

(Table 1) contd.....

Variables	No. of Respondents	Percentage (%)*
Predisposing factors for consumption		
Feed shortage	245	100
Nutritional deficiency	189	77.1
Excessive consumption	134	54.7
Unknown reasons	59	24.1

*The total respondents were (N=245) but some of the percentages do not come to 100 because the respondents had a chance to answer more than one answer.

Table 2. Summary of poisonous plant parts, signs, species affected and source of the plants.

Scientific Name	Local Name (Qafaraf)	Poisonous Part	Clinical Signs	Species Affected	Source
<i>Capparis tomentosa</i>	Andela	Leaf, Seed pod	Bloating, Death	Camel	Both wild and domestic
<i>Prosopis juliflora</i>	Datihara	Leaf, Seed pod	Bloating, Lower jaw dislocation	Camel, ovine, caprine, bovine	Both wild and domestic
<i>Parthenium hysterophorus</i>	–	Whole	Anuria, hematuria	Camel, ovine, caprine, bovine	Both wild and domestic
<i>Lantana camara</i>	–	Leaf	Photosensitization, bloody urine	Camel, bovine, caprine	Wild
NA	Asihara	Leaf, fruit	Bloating	Camel, caprine	Domestic
NA	Adihara	Leaf	Bloating	Caprine	Wild
NA	Boboe'ita	Leaf	Death	Caprine	Wild
<i>Sorghum bicolor</i>	Basinga	Seedling	Bloating, death	Bovine, caprine, ovine	Domestic
Grass species	Ayiso	Whole	Bloating, inappetance	Bovine, ovine	Both wild and domestic
Bracken fern (<i>Pteridium aquilinum</i>)	–	Leaf	Bloody urine	Camel, bovine, caprine	Wild
<i>Medicago burweed</i>	–	Whole	Bloating	Bovine, ovine	Wild
<i>Snowdonia polystachia</i>	–	Whole	Bloating, diarrhea	Camel, bovine, caprine	Domestic
<i>Prunus Africana</i>	–	Leaf	Bloating, salivation	Bovine, caprine	Wild
<i>Solanum incanum</i>	–	Fruit, Seed	Diarrhea, lacrimation, incoordination, inappetance	Camel, bovine, caprine, ovine	Wild
<i>Crotalaria incana</i>	–	Fruit, Seed	Diarrhea, depression	All animals	Both wild and domestic
<i>Plantago lanceolata</i>	–	Whole	Bloating, anuria	Bovine, ovine	Wild
<i>Amaranthus spp.</i>	–	Leaf	Bloating, Bloody urine	Camel, bovine, caprine, ovine	Wild
<i>Acacia absynica</i>	Goronta	Leaf	Bloating	Bovine, caprine	Wild
<i>Datura stramonium</i>	–	Fruit, Seed	Depression, erection of Hair, bloating	Bovine	Wild
<i>Hibiscus ludwigii</i>	–	Leaf	Bloating	Caprine, ovine	Wild
<i>Maytenus senegalensis</i>	–	Leaf	Bloody urine	Camel, Bovine caprine, ovine	Wild

NA= Not Identified

Table 3. Botanical and veterinary frequency, exposure level and season of occurrence of poisonous plants.

Scientific Names	Local Name (Qafaraf)	Botanical Frequency	Veterinary Frequency	Exposure Level	Season
<i>Capparis tomentosa</i>	Andela	156	Bloating (136), Death (20)	Single	Any time
<i>Prosopis juliflora</i>	Datihara	133	Bloating (22), Lower jaw dislocation (111)	Repeated	Winter
<i>Parthenium hysterophorus</i>	-	124	Anuria (34), hematuria (90)	Repeated	Summer, autumn
<i>Lantana camara</i>	-	56	Photosensitization (41), bloody urine (15)	Repeated	Summer
NA	Asihara	87	Bloating (87)	Single	Summer
NA	Adihara	28	Bloating (28)	Repeated	Summer

(Table 3) contd....

Scientific Names	Local Name (Qafaraf)	Botanical Frequency	Veterinary Frequency	Exposure Level	Season
NA	Boboe'ita	12	Death (12)	Repeated	Summer
<i>Sorghum bicolor</i>	Basinga	117	Bloating (85), death (32)	Single	Summer, autumn
Grass species	Ayiso	141	Bloating (122), inappetance (19)	Repeated	Summer
Bracken fern (<i>Pteridium aquilinum</i>)		21	Bloody urine (21)	Repeated	Winter
<i>Medicago burweed</i>		13	Bloating (13)	Single	Summer
<i>Snowdonia polystachia</i>		15	Bloating (6), diarrhea (9)	Single	Summer
<i>Prunus Africana</i>		8	Bloating (3), salivation (5)	Repeated	Summer
<i>Solanum incanum</i>		6	Diarrhea (4), incoordination (2)	Single	Summer
<i>Crotalaria incana</i>		2	Diarrhea (1), depression (1)	Single	Summer
<i>Plantago lanceolata</i>		3	Bloating (2), anuria (1)	Repeated	Any time
<i>Amaranthus spp.</i>		2	Bloating (1), bloody urine (1)	Repeated	Summer
<i>Acacia absynica</i>	Goronta	34	Bloating (34)	Repeated	Any time
<i>Datura stramonium</i>		4	Depression (1), erection of hair (1), Bloating (2)	Single	Any time
<i>Hibiscus ludwigii</i>		1	Bloating (1)	Repeated	Summer
<i>Maytenus senegalensis</i>		1	Bloody urine (1)	Single	Any time

Leaf part (42.8%), bloating as a clinical sign (66.7%) and Aba'ala district (81%) were among the category of the variables of identified poisonous plants with higher frequency (Table 4).

Table 4. Frequency of parts, season of occurrence, signs and origin of poisonous plants.

Characteristics of Variables	Frequency	Percentage (%)
Plant parts		
Leaf	9	42.8
Leaf and Seed pod	2	9.5
Leaf and fruit	1	4.8
Whole	5	23.8
Fruit and Seed	3	14.3
Seedling	1	4.8
Season	-	-
Summer	12	57.2
Summer and autumn	2	9.5
Winter	2	9.5
Any time	5	23.8
Signs*		
Bloating	14	66.7
Diarrhea	3	14.3
Anuria	2	9.5
Lower jaw dislocation	1	4.8
Hematuria	1	4.8
Photosensitization	1	4.8
Bloody urine	4	19.0
In appetance	1	4.8
Salivation	1	4.8
In coordination	1	4.8
Depression	2	9.5
Erection of hair	1	4.8
Death	3	14.3
Exposure	-	-
Single	9	42.9

(Table 4) contd.....

Characteristics of Variables	Frequency	Percentage (%)
Repeated	12	57.1
Species Affected*	-	-
Camel	10	47.6
Bovine	15	71.4
Caprine	15	71.4
Ovine	10	47.6
Origin*	-	-
Aba'ala	17	81.0
Asayita	8	38.1
Gewanie	11	52.4

*The total poisonous plants were (N=21) but some of the percentages do not some to 100 because some of the plants had caused more than one signs, affected more species of animals and found in more than one origin.

Poisonous Plants Collected from the study areas.



Fig. (1). Picture of *Capparis tomentosa* ('Andela')



Fig. (2). Picture of 'Asihara'



Fig. (3). Picture of 'Boboe'ita'



Fig. (4). Picture of *Solanum incanum*



Fig. (5). Picture of *Parthenium hysterophorus*



Fig. (6). Picture of *Lantana Camara*



Fig. (7). Picture of 'Adihara'



Fig. (8). Picture of *Prosopis juliflora* ('Datihara')

4. DISCUSSION

Animal poisoning due to plants constitutes one of the most important health problems to livestock in countries with extensive production system [2]. In this study, the respondents have showed that livestock health disorders due to phytopoisoning cause a significant morbidity and mortality in animals in their areas.

The major predisposing factors for the occurrence of plant poisoning in the study areas were feed shortage, nutritional deficiency and excessive consumption. Afar region is one of the pastoral areas of Ethiopia with lower rainfall and limited plant coverage but rich in livestock production potential. This condition showed that there is long dry period and feed shortage in the region. Hence, due to feed shortage, animals are enforced to feed on poisonous perennial shrubs and bushes surviving the environment which are known to contain poisonous metabolites. In addition, there is a sudden consumption of new plants while migrating and excessive consumption of plants grown following short rainy season which contributed to phytopoisoning. Accordingly, the common poisoning seasons complained were at the end of rainy season (August-September) and during drought time (February-May). This finding is in agreement with the similar reports from Wollega, Ethiopia [14, 15].

According to this study, a total of 21 plants were identified and documented to have a poisonous effect on livestock. The poisonous plants frequently described by the respondents were *Capparis tomentosa*, *Prosopis juliflora*, *Parthenium hysterophorus*, *Lantana camara*, *Acacia abyssinica*, *Sorghum bicolor*, *Datura stramonium*, *Plantago lanceolata*, Grass species such as *Panicum* species, Bracken fern (*Pteridium aquilinum*) and *Solanum incanum*. Reports from Adama, Ethiopia [16] and from Wolllega, Ethiopia [14, 15] have documented *Parthenium hysterophorus*, *Lantana camara*, *Sorghum bicolor*, *Datura stramonium*, *Plantago lanceolata*, *Panicum* grass species and Bracken fern (*Pteridium aquilinum*) as the most frequently implicated poisonous plants which are in agreement with the current finding.

In addition, the importance of *Snowdenia polystarchia*, and *Sorghum bicolor* as causes of livestock poisoning have been reported [17]. Similarly, *Lantana camara* causes similar effect in Columbia [18] and in Swaziland [19]. Bracken fern is also widely distributed in many parts of the world including Ethiopia. Its existence and importance as a cause of bloody urine has been previously shown in different regions [20] and it has also been reported in South Africa [21]. Various studies conducted on this issue indicated that poisonous plants may grow together with forage plants; therefore, readily accessible to grazing animals. Under normal conditions only a few poisonous plants can be considered sufficiently palatable. But during shortage of pasture and forage animals may be forced to browse these poisonous plants [16, 22, 23].

The respondents of this study showed that when camels and small ruminants feed on 'Andela' (*Capparis tomentosa*) the leaf causes bloating but its seed pod is fatal to both animals. A leaf of 'Adihara' causes bloating in goats but it is a good feed to other large animals. The leaf and fruit of 'Asihara'

causes bloating in animals especially camels and goats but after repeated exposure it becomes edible without serious effects. It grows at the end of rainy season or any time in irrigation fields. A leaf of 'Bobe'eita' is fatal to goats but it is a common feed to camels and it is commonly found in high hills. The seedling stage of 'Basinga' (*Sorghum bicolor*) can cause bloating in all animals but it may kill animals if it is overtaken at the same time. A leaf of 'Datihara' (*Prosopis juliflora*) is not palatable by animals due to its repellent nature but during drought times animals may be enforced to consume some as it is ever green and it causes bloating. Although its seed pod is palatable by animals, it can cause lower jaw dislocation when it is consumed after it is dropped and decayed in the ground and when it is not consumed together with other feed types [1]. Any type of grass especially *Panicum* grass species emerging at the beginning of rainy season have the potential to cause bloating and/or diarrhea as the animals consume much of it at a time following long dry periods.

The major plant parts that caused poisoning were leaves as these parts are easily accessible and repeatedly fed by animals. This study also revealed that bloating and other GIT disturbances, salivation, bloody urine and inappetance were among the frequently manifested signs by poisoned livestock. This finding is in agreement with the reports in Wollega, Ethiopia [14, 15]. Furthermore, this study showed that caprine and bovine followed by camels and ovine were the most frequently poisoned animals which did not agree with the reports from Wollega. This could be due to the difference in livestock species abundance in which small ruminants and camels constitutes majority of livestock population in the current study area.

The clinical sign with leading veterinary frequency was bloating as the poisonous plants primarily affect the digestive system of animals. Moreover, majority of the poisonous plants mainly occur on the rainy season because following the rainfall a lot of plants will grow up and causes poisoning after repeated exposure. This finding is in line with the findings in Wollega, Ethiopia [14, 15]. The poisonous plants with higher botanical frequency identified by respondents were *Caparis tomentosa* and *Prosopis juliflora* which differed from the above reports because of the difference in climatic conditions and plant coverage in the current study areas.

CONCLUSION

This study identified and documented a total of 21 plants having a poisonous effect on livestock. The poisonous plants with higher botanical frequency were *Capparis tomentosa* and *Prosopis juliflora*. Feed shortage, nutritional deficiency and excessive consumption were the major predisposing factors for the occurrence of plant poisoning. The common poisoning seasons were at the end of rainy season and during drought time. This study also revealed that bloating and other GIT disturbances were among the frequently manifested signs by poisoned livestock. Moreover, this study showed that caprine and bovine followed by camels and ovine were the most frequently poisoned animals. Hence, phytopoisoning is commonly occurring and challenging health of livestock in the area. Therefore, proper range management should be practiced

to decrease the danger of plant poisoning to animals and all concerned bodies should collaborate on pasture and water development programs to minimize the risk of enforced consumption of livestock on poisonous plants due to feed shortage.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

RESEARCH INVOLVING PLANTS

All the experimental research on plants was in accordance with "B. Tony, "Collection and preserving plant specimens", a manual. Queensland Herbarium, Department of Science, Information Technology and Innovation, 2nd ed, Brisbane Botanic Gardens Mt Coot-tha, Mt Coo-tha road, Toowong Brisbane QLD 4066, 2016".

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

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CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

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