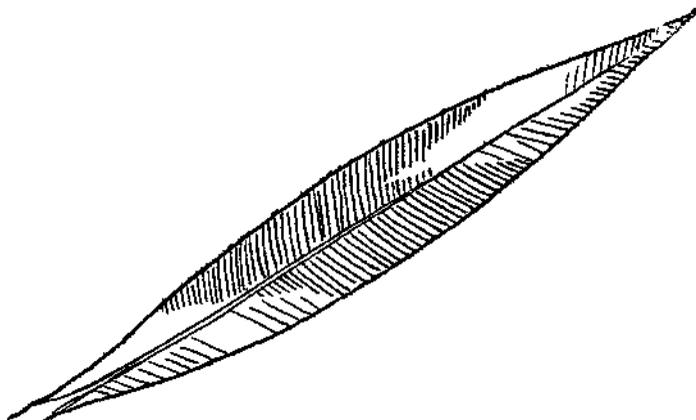


University of Arizona
Agricultural Experiment Station.

Bulletin No. 59.



Oleander Poisoning of Live-
stock.

By F. W. Wilson.

Tucson, Arizona, April 15, 1909.

UNIVERSITY OF ARIZONA

AGRICULTURAL EXPERIMENT STATION.

GOVERNING BOARD.

(Regents of the University)

Ex-Officio.

HON. JOSEPH H. KIBBY,	-	-	-	Governor of the Territory.
HON. KIRKE T. MOORE,	-	-	-	Superintendent of Public Instruction.
Appointed by the Governor of the Territory.				
MERRILL P. FREEMAN,	-	-	-	Chancellor.
GEORGE J. ROSKRUGE,	-	-	-	Secretary.
CHARLES H. BAYLESS, A. M.,	-	-	-	Treasurer.
ANTHONY V. GROSSETTA,	-	-	-	Regent.

KENDRIC C. BABCOCK, Ph. D., - - President of the University.

STATION STAFF.

ROBERT H. FORBES, M. S.,	-	-	-	Director and Chemist.
JOHN J. THORNER, A. M.,	-	-	-	Botanist.
ALBERT E. VINSON, Ph. D.,	-	-	-	Biochemist.
FREDERICK W. WILSON, B. S.,	-	-	-	Animal Husbandman.
G. E. P. SMITH, C. E.,	-	-	-	Irrigation Engineer.
WILLIAM B. MCCALLUM, Ph. D.,	-	-	-	Associate Botanist.
J. ELIOT COIT, Ph. D.,	-	-	-	Horticulturist.
WILLIAM H. ROSS, Ph. D.,	-	-	-	Assistant Chemist.
ROBERT W. CLOTHIER, M. S.,	-	-	-	Agriculturist.
FRANK C. KELTON, B. S.,	-	-	-	Assistant Engineer.
T. D. A. COCKERELL,	-	-	-	Consulting Entomologist.
WILBUR O. HAYES,	-	-	-	Secretary.

The Experiment Station office and the botanical and chemical laboratories are located in the University main building at Tucson. The range reserves (cooperative, U. S. D. A.) are suitably situated adjacent to and southeast of Tucson. The work in agriculture, horticulture and animal husbandry is conducted mainly on the Experiment Station farm, three miles northwest of Phoenix, Arizona. The date-palm orchards are three miles south of Tempe, (cooperative, U. S. D. A.), and one mile southwest of Yuma, Arizona, respectively.

Visitors are cordially invited, and correspondence receives careful attention.

The Bulletins, Timely Hints, and Reports of this Station will be sent free to all who apply. Kindly notify us of errors or changes in address, and send in the names of your neighbors, especially recent arrivals, who may find our publications useful.

Address, THE EXPERIMENT STATION,
Tucson, Arizona.

CONTENTS.

	PAGE
General discussion.....	383
Observations in Arizona.....	386
Experiments with oleander.....	387
Case I (horse).....	388
Case II (horse).....	389
Case III (cow).....	391
Case IV (mule).....	393
Case V (sheep No. 1).....	395
Case VI (sheep No. 3).....	395
Case VII (sheep No. 4).....	395
Treatment.....	395
Summary.....	396

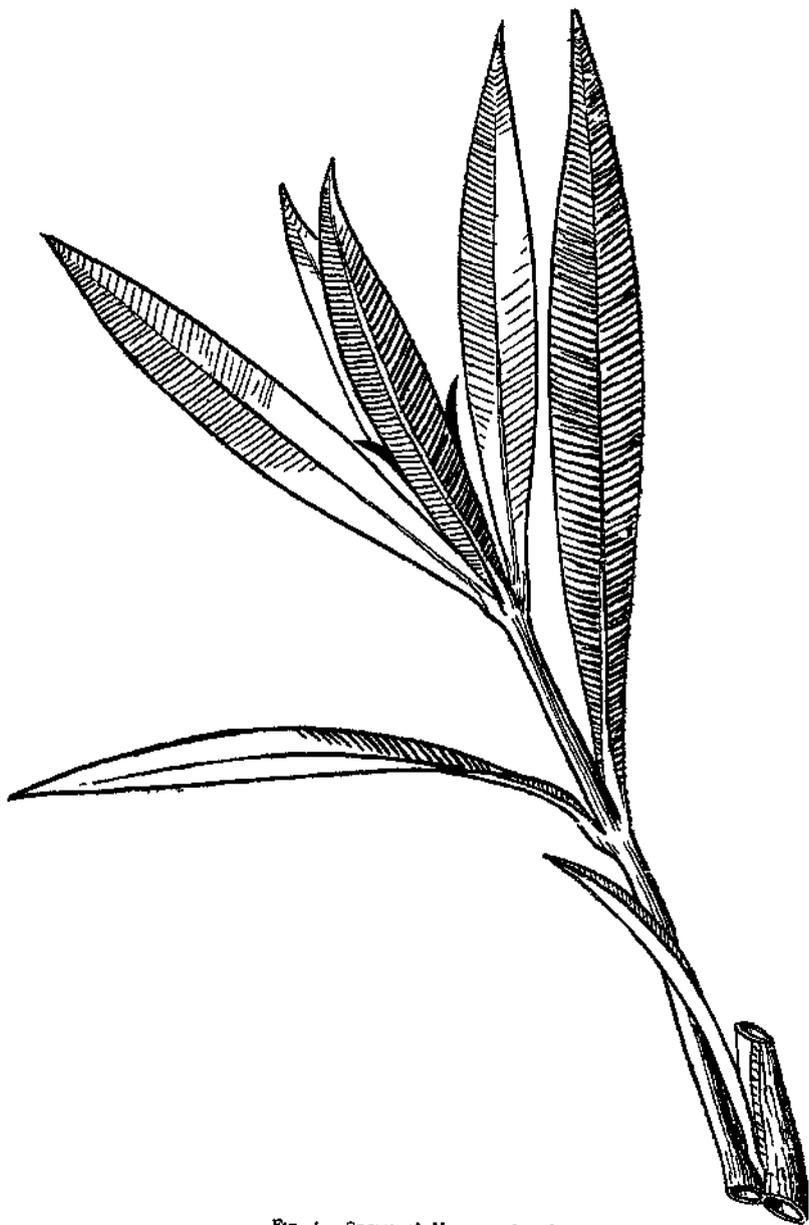


Fig 1 Spray of *Nerium oleander*

OLEANDER POISONING OF LIVE STOCK.

By F. W. Wilson

GENERAL DISCUSSION.

The oleander, *Nerium oleander*, is an old-fashioned shrub, familiar to most residents of the South and the Southwest. It occurs native in the Mediterranean regions of the Old World, also in Persia, Japan, and the East Indies, whence it has been distributed to most warm countries. Several species are known, most important of which, next to the common oleander, is the sweet-scented species, *Nerium odorum*, which has pink flowers and a strong, musk-like odor.

Oleander grows readily in the open throughout the southern part of the United States, and is much used as a house plant in many northern and eastern homes. In southern Arizona it is frequently grown as a screen to hide unsightly premises, or is planted in yards as an ornamental. Those commonly found in America are probably of the same species, but sweet-scented and non-scented as well as white and pink flowering varieties grow in this section of the country. Both the white and pink varieties were used in this investigation. According to our experience, however, there is little or no difference in their poisonous action.

Three active principles, all of which are glucosides, have been found in the oleander. The most important of these, oleandrin, may be isolated as an amorphous mass and shows all the characteristics of digitalin. The remaining two, neriin and nerianthin, have less marked poisonous properties

Nerianthin has been found only in oleanders grown in northern Africa and is believed to be a decomposition product of oleandrin. Neriin, according to Schmiedeberg, appears to

be identical in chemical and physiological properties with digitaleïn, a second principle of digitalis. As a drug, oleander exhibits the same properties as digitalis or foxglove, and at one time, especially during the middle ages, was used frequently in medical practice. It has no superiority over digitalis and has fallen into disuse. Like digitalis it is a powerful heart stimulant. The purified oleandrin shows all the characteristic poisonous activities of digitalin, and very minute quantities in the frog will arrest the heart's action in systole.

The sequence of phenomena in cases of poisoning by the pure active substances of the digitalin group, which includes not only oleandrin but several other active principles from dogbane, also called Canadian or Indian hemp (*Apocynum cannabinum*), and various African arrow poisons, is given by Schmiedeberg as follows: first, increase of normal arterial pressure as a rule, but not necessarily accompanied by decrease of pulse; second, continuation of the higher blood pressure with more than normally high pulse; third, continued high blood pressure with great irregularity of heart activity and changeable pulse; fourth, rapid sinking of blood pressure, sudden stopping of heart and death.

The supposition that emanations from the plant are poisonous has been shown to be fallacious. The active principles are non-volatile and actual tests in closed rooms have demonstrated the harmless nature of the perfume. The poisonous or medicinal properties of the oleander were known to the ancients and mention is made thereof by Pliny, Discorides, Galen, and other early writers. Eber Barthar, an Arabian, writing in the year 1248, mentions its application and action in several skin diseases. It has also been used in southern Europe to destroy rats.

A very complete compilation of the most interesting cases of poisoning by this shrub has been made by Schmiedeberg¹ some of the most interesting of which are given here. These are not only of general interest but serve to illustrate the dangerous character of this plant.

¹Arch. Path. u. Pharm. 16. 149 (187).

Five soldiers² were poisoned by stirring a pot of barley soup with an oleander branch. Vomiting occurred. In one case there was dizziness and abdominal pain; in another, dulling of the senses and insensibility to external pressure.

Three hundred French soldiers³ in the army corps of Marshal Suchet in Catalonia became sick after eating roasted meat that had been skewered with oleander sticks. A number of those who were poisoned died.

A French soldier⁴ near Madrid used an oleander branch freed of the bark as a skewer. Of twelve soldiers who ate the meat, seven died.

Three Italian women drank alcoholic tincture of oleander thinking that it was brandy. They suffered from pain in the abdomen, vomiting, unconsciousness, and bloody stools. The pulse was light, thready, and irregular. All recovered.

Two cases are recorded in the Indian Medical Gazette.⁵ The first, in 1881, was that of a Hindu who had taken an unknown amount of the root with suicidal intent. Vomiting ensued before he reached the hospital. When received he was mentally dazed. Pupils of the eyes were dilated and fixed, pulse 36 per minute and light, gait staggering, respiration rapid, and skin normal. Two hours later epileptiform convulsions occurred, temperature 97.4 by axilla, semi-coma. After this, violent convulsions similar to hysterio-epilepsy occurred every half hour lasting about one and one-half minutes, temperature rose to 101 and pulse to 120. Twelve hours later he was still unconscious, pulse 40, respiration 18, temperature 98. Five days later the pulse was 44, and there were evidences of mild mania, such as singing and saying that there was a god in his abdomen and that he wanted a piece of glass to cut him out.

The second case, in 1887, was that of a Hindu who took an infusion of about four ounces of the root at 8 A. M. In about one hour he was seized with vomiting and severe cramps in the abdomen

²Journal de chim. med. II Ser. IX, 535, 1843.

³Journal de pharm. et chim. 32, 332, 1857; Journal de chim. med. IV, Ser. III, 249, 1857.

⁴Journal de chim. med. II Ser., IX, 393, 1843.

⁵Through Therap. Gaz., July, 1888, p. 452

and extremities One hour later he became insensible, but was not seen by the doctor until near 4 p. m. At that time he was unconscious, skin cold and clammy, pulse weak and thready, jaw muscles stiff, fingers rigid, and he had light convulsive spasms. He remained in the hospital two nights and one day and was then removed to his house, still unconscious and with increasing collapse. Death occurred five days after taking the poison.

One experiment⁶ is recorded in which a cow and two goats were poisoned by oleander leaves given with other feed. Coldness of the nose and extremities, marked tremors in posterior extremities and cramp-like contractions of all the muscles were observed. The goats passed into a general paralytic condition and died in about eleven hours, while the cow died paralyzed twenty-four hours after eating the leaves.

OBSERVATIONS IN ARIZONA.

The opportunities in this region for domestic animals to obtain oleander are many. In towns it is not unusual for the family horse to graze on the lawn or to feed on the fresh grass which has been clipped with the mower. Thus, if oleanders are growing in the yard, the animal is quite likely to obtain a few of its leaves. Sometimes in the heat of summer when flies are loathsome, dairy cows will run hurriedly under brush and nip off leaves as they go. If the bushes happen to be oleanders fatal results may follow. Nervous horses are apt to nip nearby trees which may be oleander and result in poisoning.

Animals which have been accustomed to oleanders do not as a rule bother them, but instances where they have eaten the leaves accidentally with their feed are frequent. Only one case has been reported where an animal, having eaten oleander leaves and recovered, has repeated his action and eaten them a second time. In general, stock will not eat the plant unless they have an intense craving for green feed or, on the other hand, after being on green feed for some time, they may crave something dry.

⁶Centralb f klin Med, I, 161.

While the work with oleander was being conducted at the Experiment Station Farm near Phoenix, a number of cases of poisoning that had occurred previously were reported to the writer by farmers. To illustrate losses of this nature several of these reports are repeated, as follows:

Mr. B——, Phoenix, reported the loss of a horse supposed to have obtained the poison while passing under oleanders growing on the Station farm.

Dr. R——, Phoenix, reported at least 30 cases of oleander poisoning during his practice in and near Phoenix.

Mr. M——, of Phoenix, reported the loss of a fine team of draft horses which were the property of the city. Later an unclaimed stray horse, that had been impounded by the authorities, and given a feed of oleander leaves in a bran mash by one of the stable boys, died showing symptoms similar to those observed in the team of draft horses.

Mr. R——, Phoenix, reported a number of cases of oleander poisoning among his own animals and those of several of his neighbors.

Mr. A——, Phoenix, reported that he had noticed a driving horse eating several oleander leaves in the morning with no bad effects. He stated, however, that the animal had just been fed and watered.

Numerous other cases were reported but no definite knowledge of their nature could be obtained. A number of deaths from uncertain causes have also been accredited to oleander poisoning.

EXPERIMENTS WITH OLEANDER.

The objects of the experiments carried out at this Station were to define accurately the symptoms of an animal suffering from oleander poisoning and to determine the quantity of the plant necessary to cause death. Trials were made with green and dry leaves, flower stems, portions of the branches, and bark and roots.

Both the crude dry and green material and aqueous infusions were used. These three possible cases of poisoning were investigated since an animal might obtain dry or green leaves

in his feed, nip the green leaves directly from the bush, or obtain the poison by drinking water into which oleander leaves had accidentally fallen. The alcoholic extract was not used since there is little or no probability of poisoning with it, although the chief poisonous principle, oleandrin, is very much more soluble in alcohol than water.

The animals used were two horses, a cow, a mule, and several sheep. The first method of feeding the leaves was to place them in a grain ration. It was soon discovered that a definite amount could not be given in this way, because the animal would not eat all of the leaves. When once he had taken enough to make him sick he could not be induced to touch a second dose. In later experiments the desired amount was placed in large gelatin capsules, which are quite easily administered and insure accurate dosing. The aqueous solution, when used, was added to a pint of water and given as a drench. It was prepared by macerating the green leaves over night in a small container with distilled water at ordinary temperatures.

In the following cases the results of our experiments with each animal will be given in detail in regard to dose, symptoms, and post-mortem appearance.

CASE I (HORSE).

A sorrel mare about fifteen years old, in good health and spirits with the exception that she had the heaves, was used. Temperature was normal and pulse a little above normal.

March 17, ten grams of green oleander leaves were fed in a bran mash. No perceptible change was noticed.

March 24, twenty-five grams of green oleander leaves were given in capsules as she evidently remembered the former dose and would not touch the tempting mash.

March 26, the animal was in low spirits and at 8 A. M. was purging freely. At 5 P. M. she was very weak and refused to eat or drink.

March 27, the mare was found dead in the morning; probably having died early in the night. There was no evidence of a struggle or pain at any time. No post-mortem was made as

we were not prepared to hold one. In fact it was not expected that the mare would die at this time.

CASE II (HORSE).

The second horse was a bay gelding, old but in perfect health and spirits. Pulse and temperature were normal for his age.

March 24, an aqueous infusion of 10 grams of green leaves was given with a bran mash. There was no effect other than a slight purging at the end of 24 hours. Before further experiments were made the animal was allowed to fully recover.

April 17, at 9 A. M. six grams of dry oleander leaves, picked up from the ground under and near the bushes, were fed. There seemed to be no change in the animal's condition until the next day at 4:30 P. M., when he began to purge quite freely. This was accompanied by some wind, the odor of which resembled that of sour oleander leaves, after standing in water for several

days. Feces were olive green in color. Pulse rapidly rose to 60, accompanied by a slight rise in temperature. By ten o'clock the next day the horse recovered his normal health and spirits and ate very heartily of green feed, his mouth being quite sore from the effects of the poison.

April 19, the leaves remaining from the previous infusion, which in a partly dried condition weighed twelve grams, were fed. The

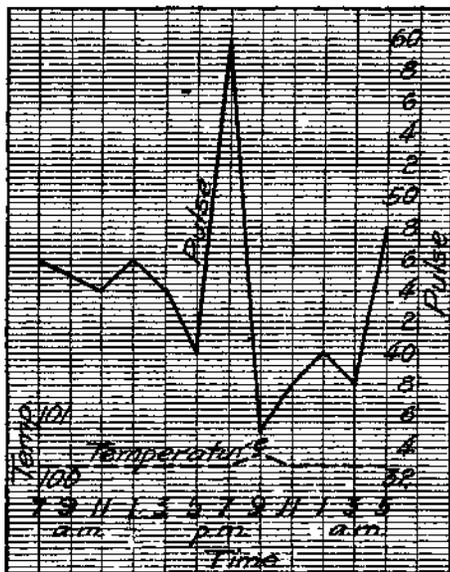


Fig. 2. CASE II, showing the temperature and pulse of horse when fed six grams of dry oleander leaves, with recovery

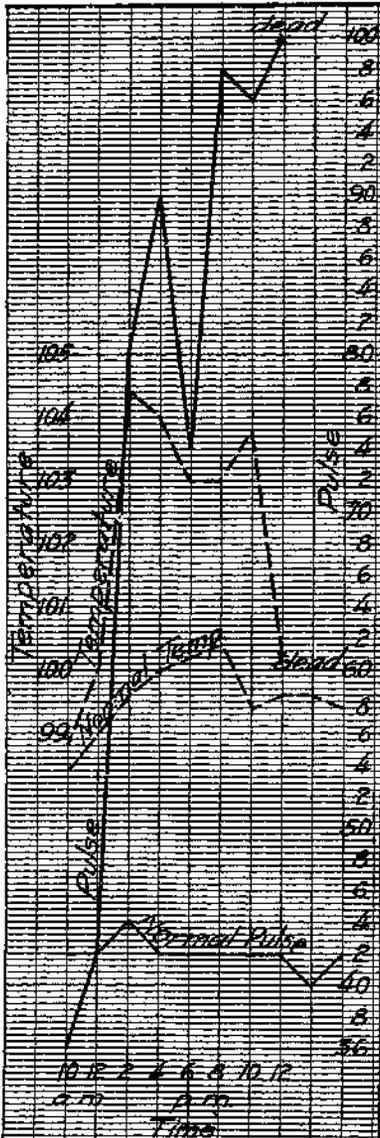


FIG. 3. CASE 11, showing temperature and pulse of horse when fed 14 grams of dry oleander with fatal results, and showing the temperature and pulse of an old horse under normal conditions.

horse seemed in a normal condition for a few hours. Six hours after the feed both the temperature and pulse rose gradually but later dropped very low. At the end of four hours he was in a critical condition, and it seemed at the time he would die. His temperature then rose gradually to 102.8 and pulse to 70. After that there was a gradual decrease in temperature to 97.2 and in pulse to 48. His spirits and general health at this time were decidedly poor, but with good care he fully recovered.

April 23, at 10 A. M. he was again fed 14 grams of dry oleander leaves. His pulse rose gradually from 36 to 100 at 12 P. M., his temperature standing at 100. About 12:30 P. M. he lay down but rose up immediately and then died without a struggle. A short time before his death white tenaceous feces accompanied with some wind and blood were passed. The extremities were cold

and the body was wet with sweat. There seemed to be some pain at this time as the muscles of the abdomen were somewhat drawn and short groans were emitted. About four hours before death a slow thready pulse was recorded.

At 10 A. M. the next morning the post-mortem examination was held with the following findings:

The *adipose tissue* was yellowish in color, which is characteristic of a case of this kind. This was later found to be true in the case of all animals used in these experiments.

The *spleen* was normal.

The *veins* in the intestines and stomach were filled with blood.

The *kidneys* were normal.

The *mucous membrane* of the stomach was sloughed off to some extent. That of the mouth was dark in color. The entire mouth was swollen and seemed very sore, judging from the fact that the animal ate only soft and tender food.

The *stomach* showed much discoloration similar to that sometimes caused by gastritis. However, the action of the heart in this case would show that oleander poisoning was the cause of death.

The *heart* was very soft and pliable and showed overwork during the action of the poison. The right and left auricles were filled with post-mortem clots.

The *tongue* was enlarged and very dark in color.

CASE III (COW).

A young milch cow that had been sick for some time without much chance for recovery was used in this trial. She seemed to be partly paralyzed and was unable to get on her feet. Her appetite was normal and otherwise she was in good health. After death the trouble was located in her right kidney, which was enlarged and filled with fluid. Dr. F. O. Richmond, the veterinary surgeon who directed the post-mortem, stated that the oleander could not have caused the kidney trouble and a close examination of the sheep and horses used in the other experiments did not show similar symptoms.

The animal had been sick so long that it was decided to give her a fatal dose at once. She was therefore fed eighteen grams of green leaves on April 17th and died without any perceptible pain. As death approached the extremities grew cold while the body was yet warm. The heart action was so low that the pulse could not be accurately taken for some hours before death. The post-mortem findings were as follows:

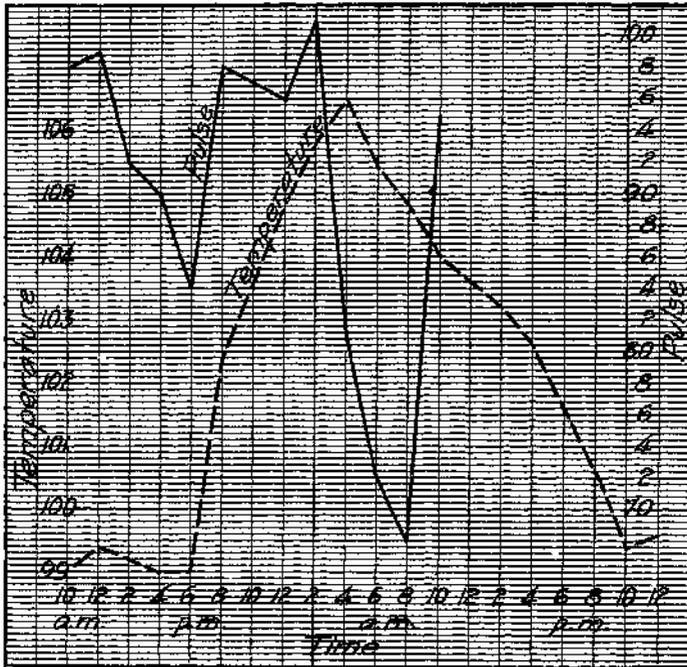


FIG. 4. CASE III, showing the temperature and pulse of cow when fed 18 grams of green oleander leaves.

The *adipose tissue* was yellowish in color.

The *spleen* was normal.

The *left kidney* was normal; the *right kidney* was enlarged and filled with fluid. As noted above this did not cause death.

The *mucous membranes* were the same in appearance as in the horse.

The *stomach* showed discoloration and the veins were dis-
tended.

The *heart* stopped on systole. The organ was quite soft.

The *lungs* were normal.

The *brain* was normal.

The *liver* was normal.

CASE IV (MULE).

In this experiment an old mule was used and proved to be
an excellent subject. He was in perfect health and spirits. His
temperature and pulse were normal. After the first dose of

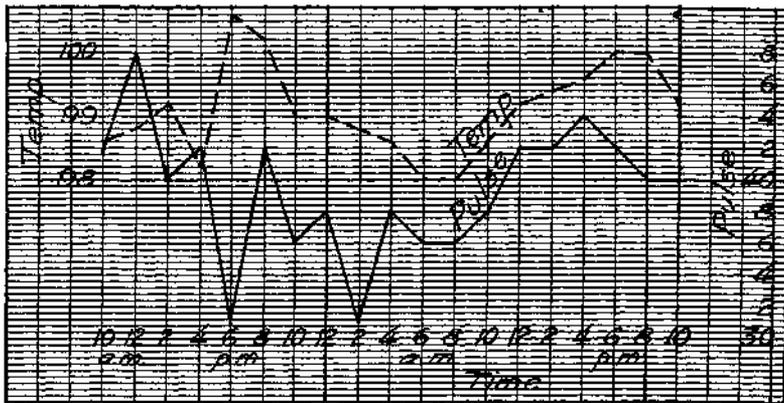


FIG. 5. CASE IV, showing the temperature and pulse of mule given an infusion of 15 grams of green oleander leaves, with recovery.

poison he seemed to know that his life was in danger and it
became very hard to administer further poison even in the
capsules.

April 23, the first trial was made with an aqueous infusion
prepared from fifteen grams of green oleander leaves and given
on a full stomach. There was very little change in the animal
except that he seemed in excellent spirits, the poison acting
apparently as a stimulant in this case. A slight rise in temper-
ature accompanied by a slight increase in pulse was the only
change noted. The animal was allowed to fully recover his
normal condition.

May 3, the second trial was made with twenty-six grams of green leaves fed on a full stomach. At the end of twenty-four hours the pulse reached 92 and the temperature 102. At the end of thirty-six hours both pulse and temperature began to drop. The excellent constitution of the animal, coupled with the method of feeding on a full stomach, probably pulled him through. This was the largest dose used and the animal did

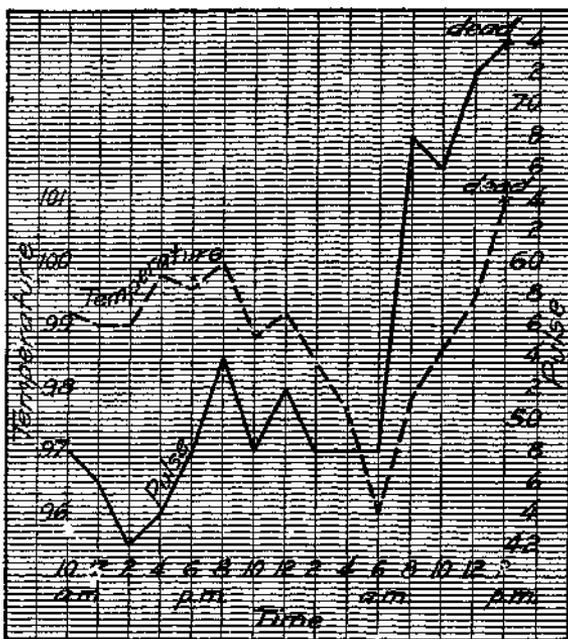


FIG. 6 CASE IV showing the temperature and pulse of mule given 24 grams of dry oleander leaves on a full stomach. Death resulted.

not seem to be very sick at any time. However, he purged quite freely and there was decided coldness of the extremities. His mouth did not become sore and his appetite remained good. This would lead to the conclusion that more leaves are required to produce fatal results when taken on a full stomach than otherwise. Also, that an animal would eat while under the influence of the poison if his mouth were not sore. The animal recovered.

Later a third trial was made with the same mule, using twenty-four grams of dry oleander leaves on a full stomach. He died in twenty-four hours showing the same symptoms that the other animals had shown. The post-mortem findings were the same as in the horse.

CASE V (SHEEP NO. 1).

A wether lamb, six months old, was fed one gram of green oleander leaves at 6 P. M. and died the next night at 12 P. M. The temperature and pulse were not taken but it was noticed that the animal was in a partly unconscious state for several hours before death. The mouth and nostrils were sore for six hours before death. The post-mortem findings were the same as in the cow.

CASE VI (SHEEP NO. 3).

An old ewe was fed two grams of oleander root without any effect. Two days later she was fed two grams of petals from oleander flowers. There was no effect. Two days after that she was fed two grams of cross section of an oleander branch with no effect. Again, one week later she was fed four grams of green oleander leaves and died in twenty-four hours. The post-mortem findings were the same as in the cow.

CASE VII (SHEEP NO. 4).

An old ewe was fed two grams of dry oleander leaves and died in thirty hours. The post-mortem findings were the same as in the cow, with the exception that a small quantity of undigested leaves was found in the throat. Near the small wad of leaves the mucous membrane was discolored to some extent.

TREATMENT.

There is little or no treatment that can be offered, if the animal has received a fatal dose. When oleander has been taken by human beings an emetic may be used with more or less success if given promptly. The case should then be treated by a physician who will combat symptoms as they arise, remembering that oleander is practically identical with digitalis in its poisonous action. In the case of live stock emetics can not be used with success.

SUMMARY.

Oleanders are poisonous when eaten by human beings, rodents and common farm animals, but do not exhale poisonous materials when growing in the house. The manner of obtaining the poison is generally accidental and its presence is not usually known until death is approaching. Dry leaves are poisonous as well as green leaves. There is little danger of the animal obtaining the poison from leaves in drinking water. The amount of poison necessary to cause death is small, but depends also on the condition of health of the animal. The physiological effects of oleander are similar to those of digitalis and if enough poison is obtained the patient is sure to die.

The amount of oleander necessary to cause death in horses ranges from fifteen to twenty grams of green leaves, and from fifteen to thirty grams of dry leaves. This depends on the condition of the animal at the time the poison is obtained. A full stomach will necessitate more poison. In the case of cows it is safe to say that from ten to twenty grams of green leaves and fifteen to twenty-five grams of dry leaves are sufficient to cause death. For sheep the fatal dose of either green or dry leaves is from one to five grams. There is little danger in the bark, roots or flowers since livestock would hardly obtain sufficient poison in that way.

In the case of human beings greater care should be taken. Often persons thoughtlessly chew leaves, flowers and small sticks. Small children playing under oleanders are very apt to pick up leaves, flowers or sticks and chew them, with fatal results. In case human beings obtain oleander poison treat as directed above.

The general symptoms are increased temperature and pulse, coldness of the extremities, warm body temperature, dilation of the pupils of the eyes, and discoloration of the mouth and nostrils, followed by sore mouth. The body becomes wet with sweat, due to the exertion caused by the powerful heart stimulation. The animal generally refuses to eat or drink during the twenty-four hours preceding death. This is usually due to soreness of the mouth and throat, making it painful to masticate

and swallow food. The bowels act often and feces are usually greenish in color. The action of the kidneys is increased slightly and color of urine is normal.

In our list of shrubs that may be planted for hedge, screen or ornamental purposes, are numerous harmless ones that compare favorably with the oleander so far as resistant and ornamental qualities are concerned. The well-known pomegranate, Japanese, California, and Amoor River privets, common myrtle, laurustinus (*Viburnum tinus*), and tamarisk may be mentioned in this connection. If oleanders are to be used, however, they should be planted only in places of safety, and not in parks, along public highways, or other drives.

There is little doubt that numerous cases of oleander poisoning have never been brought to light because of death being attributed to other sources. It is safe to say, however, that many hundreds of animals have been lost in southern Arizona from this shrub.