

## Pseudo-Affective Reflexes of Cats produced by Extracts from the Plant *Actinidia polygama*

TAKASHI HAYASHI

*Keio University, Tokyo (Japan)*

A plant, *Actinidia polygama* (Matatabi in Japanese), which is found in the middle region of Japan, has been said to be specially liked by cats. It is said that cats are attracted by the odour of these burning plants and that they display a special type of behaviour — salivation, licking, playful rubbing, rolling, treading with hind legs and finally sleeping. These signs seem to be akin to the normal sexual reflexes of cats. Physiological observations of this phenomenon have been published sporadically in Japan since 1940.

Recently the effective substances of *Actinidia polygama* were extracted by Professor Sakan (Sakan *et al.*, 1959a) and identified as follows. Three substances were said to be physiologically active. One was phenylethanol (Fig. 1). The second was a lactone

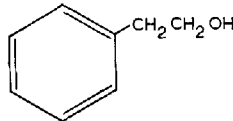


Fig. 1.  $\beta$ -phenylethanol (Phenethyl alcohol).

(isoiridomyrmecine) similar to nepeta-lactone (Fig. 2), an extract of a plant which occurs in Europe and America, and which is said also to be liked by cats (Pavan, 1951, 1955, 1957). Iridomyrmecine is secreted by a species of ant, *Iridomyrmex humilis* (Pavan, 1951, 1955, 1957; Cavill and Locksley, 1957) and probably has some protective function. The third substance more recently extracted from *Actinidia*

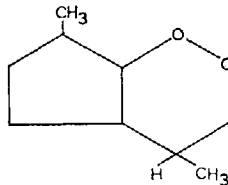


Fig. 2. Nepeta-lactone (iridomyrmecine).

*polygama* has been named actinidine. These three substances have now been synthesized.

The three substances were administered to cats with the object of investigating the claims that they can evoke reflex behaviour.

Phenylethanol is water-soluble and has a strong alcoholic smell. This substance was not attractive to cats when a quantity was placed near them in a small bowl, but it strongly induced salivation. When applied directly to the cat's tongue salivation

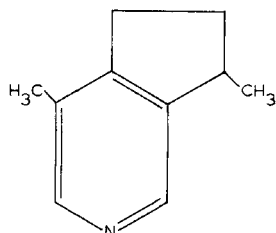


Fig. 3. Actinidine.

occurred almost instantaneously after a very short latent period. Intraperitoneal injection had no obvious effect. The salivation was therefore presumably induced by the action of phenylethanol on receptors of the tongue and buccal cavity. The reflexly evoked salivation, however, is not peculiar to this alcohol for allied alcohols with 4C and more had the same action (Table I).

TABLE I

THE ACTION OF ALCOHOLS TO PRODUCE SALIVARY REFLEXES IN CATS

<i>Alcohols</i>	<i>Salivary reflex when put in the mouth</i>
Methanol	(—)
Ethanol	(—)
Butanol	(—)
Propanol	(+)
Isopropanol	(+)
Phenylethanol	(+)

Nepeta-lactone is water-insoluble, but is readily soluble in ethanol. A 10% solution made by dissolving 100 mg in 0.1 ml ethanol and adding 0.9 ml water had a slight organic smell. This solution when presented to cats showed no attractive power. When 1.0–1.5 ml was poured into the mouth of a cat, it produced neither salivation nor behavioural change. When 1.0–3.0 ml was injected intraperitoneally, there was no salivary flow, and no behavioural deviation was observed.

Actinidine (Sakan *et al.*, 1959b) is apparently insoluble in water, but 0.1 ml of this oily fluid shaken with 100 ml of water produced an emulsion. The suspension had a strong and characteristic smell which remained in the room for 3 days then gradually disappeared.

This 0.1% emulsion of actinidine was not attractive to cats and it may even have been repellent. This lack of activity occurred with young and old cats of both sexes. When 1.0–3.0 ml was poured into the cat's mouth salivation was evoked and continued for several minutes. No behavioural change was observed, except that the animal became quieter and squatted down in a corner of the cage. When 1.0–3.0 ml of 0.1% actinidine was injected intraperitoneally salivation did not occur. When 10–20 ml of the fluid was injected the animal vomited violently several times without salivation; after the contents in the stomach were ejected, the vomiting ceased. This might mean that the vomiting did not come from stimulation of the centre in the medulla, but it could mean that the reflex came from stimulation of the stomach, through some receptor to the actinidine localized in the systemic circulation.

#### CONCLUSION

Our experiments do not support the claim that *Actinidia polygama* produces behavioural changes in cats. The salivary effect of actinidine might well be due to the solvents used in extraction. These limited experiments are not conclusive, however, in disproving the folklore associated with *Actinidia polygama* in Japan and *Nepeta cataria* in Europe and America. It is possible that the effect may vary with the sexual cycle or hormonal status of the animal, or with previous conditioned states such as domestication, or the presence of human observers. However, our results do not suggest that the substances extracted from *Actinidia polygama* will produce psychophysiological effects in the cat.

#### SUMMARY

A plant, *Actinidia polygama*, found in the middle part of Japan is reputed to be especially liked by cats. Cats are said to be attracted by the odour of the burning plant and display a special behaviour — playful rubbing, licking, rolling, treading with hind legs — which seems to be some kind of sexual reflexes. We call them 'actinidine reflexes' after the effective substance of the plant, recently extracted by Professor Sakan and identified as  $C_{10}H_{13}N$  and named actinidine.

The actinidine reflexes, called forth by the odour of the fluid, were observed in cats but not in mice, rabbits or guinea pigs. When the fluid was injected subcutaneously, intravenously or intraperitoneally, it did elicit actinidine reflexes in cats and dogs as well as in rabbits, mice and guinea pigs. The actinidine reflexes were observed when the drug was injected into the cerebrospinal fluid of cats and dogs.

An attempt has been made to determine the localization of the reflex centre in subcortical regions of animals' brains.

#### ACKNOWLEDGEMENT

After this work, I confirmed that the reflex above mentioned is easily aroused by chronic experiments in decorticated cats. It was published in International Sym-

posium on Cortico-Visceral Physiology and Pathology, at the German Academy of Sciences at Berlin, 1964. I am pleased to acknowledge the help of Professor F. R. Bell, Royal Veterinary College, London, in some of these experiments.

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