Dept. of Anatomay & Histology,
Fac. Vet. Med., Assiut University,
Head of Dept. Prof. Dr. A. Hifny.

COMPARATIVE ANATOMICAL AND HISTOLOGICAL STUDIES ON THE MEIBOMIAN (TARSAL) GLANDS IN RABBITS, CATS, GOATS, SHEEP AND CATTLE

(With 11 Figures)

By
I.A. IBRAHIM; A.M. KELANY and M. TAHA

(Received at 23/9/1992)

دراسات تشريحيه وهستولوجية مقارنه على غدد مايبوميان في الأرانب ، القطط ، الماعز ، الأغنام والماشية

اسماعيل ابراهيم ، عبدالحكيم كيلاني ، محمد طه

تم دراسة غدد مايبوميان تشريحيا وهستولوجيا في الحيوانات الآتية: الأرانب، القطط، الماعز، الأغنام والماشية. وقد وجد أن هذه الغدد موجودة في كلا الجفنين العلوى والسفلي وهي مرتبه على هيئة خطوط عمودية على محور الجفن،والغده لها قناة واحده تظهر على هيئة نقطة شفافه على حافة الجفن. ودلت الدراسة على أن العدد الكلي للغدد في الحيوانات التي درست يتراوح بين ٥٢-٧٤ غده وعدد الغدد في الأرانب ٧٤، ٦٢ في القطط، ٥٢ في الماعز، ٦٤ في الماشية. ودلت الدراسة - أيضا- أن في كل الحيوانات ماعدا القطط كان عدد الغدد في الجفن العلوى أكثر وأطول منها في الجفن السفلي، وقد تم - أيضا- دراسة التركيب الهستولوجي لهذه الغدد وقد تبين أنها غده دهنية أنبوبية حوصلية. ووجد أن درجة نشاط الحويصلات مختلفة بين الحيوانات التي درست.

SMMARY

The comparative anatomical study of the meibomian glands in rabbits, cats, goats, sheep and cattle reveals that these glands are arranged, in both eyelids, in a linear manner peripendicular on the axis of the palpebral fissure. Each gland has a single orifice appearing in the form of a light spot at the free border of the eyelid. The present study reveals that, the total number of the

meibomian glands in rabbits, cats, goats, sheep and cattle, is 64, 62, 52, 59 and 74 respectively. In all the studied animals except cats, the glands of the superior are more or less numerous and langer than those of the inferior eyelid. The histomorphological study reveals that these glands are modified sebaceous glands. The activity of the lobules is variable among the animals under investigation.

INTRODUCTION

Meibomian glands were firstly described by MEIBOMIUS (1966). These glands were recorded in eyelids of dogs (ROBERTS, 1960), cats (STRICKLAND and CALHOUN, 1963), pigs (MARTIN and ANDERSON, 1981), horses (PRINCE et al., 1960; DIESEM, 1975), cattle (NICOLAIDES et al., 1981); Sheep (DIESEM, 1975), buffaloes (PRASAD & SINHA, 1979 and MOUSTAFA, 1982) and goats (SAR and CALHOUN, 1966). The meibomian glands consist of parallel rows of lobules which have their ducts epening onto the rims of the eyelids (PRINCE et al., 1960). Affections of the meibomian glands oftenly occur in practice. On the other hand, the surgical approach of these glands necessitates an anatomical and histological study, a matter which stimulates the carring out of the present investigation.

MATERIAL and METHODS

For the anatomical study of meibomian glands, 10 fresh superior and inferior eyelids of rabbits, cats, goats, sheep and cattle were obtained. These materials were cleared by using a maxture of equal amounts of saturated solution of sodium hydroxide and glycerine. In addition five formalized eyelids from each animal species were also used. The number, position, length, shape and extension of the meibomian glands along the whole length of the eyelids was determined.

For the histomorphological study, five apecimens of the superior and inferior eyelids of each species were taken. Some of these specimens were fixed in Bouin's fluid and others in 10% formalin. The materials were then dehydrated and embedded in paraffin wax. Microtomy for these specimens were performed then the specimens were stained with Harris's haematoxylin and eosin (DRURY and WALLINGTON, 1976).

RESULTS

I) Anatomical study: In rabbits, cats, goats, sheep and cattle the meibomian glands were observed, in both eyelids, arranged in a linear manner and perpendicular on the axis of the palpebral fissure. Each gland has a single orifice which appears in the form of light spot. These orifices are not associated with hair.

The total number of the meibomian glands in rabbits, cats, goats, sheep and cattle is about 74, 62, 52, 59 and 64 respectively. In all animals studied, except cats, the glands of the superior are numerous and longer than those of the inferior eyelid (Fig. 6).

The sheet of the meibomian glands of the superior eyelid measures about 1.7 cm in rabbits, 1.8 cm in cats, 2.4 cm in goats and sheep and 4.4 cm in cattle, however that of the inferior eyelid reaches about 1.5 cm in rabbits, 1.7 cm in cats, 2 cm in goats and sheep and 3.5 cm in cattle.

As shown in Fig. 1–5 the glands of both superior and inferior eyelids in all animals examined, extend medially to the level of the dorsal and ventral puncta lacrimalis. However, the extension of the glands laterally varies among animals under examination. The glands of both eyelids in rabbits and cats do not reach the canthus, but the glands of the superior eyelid in goats, sheep and cattle extend till the medial canthus, however those of the inferior eyelid end before reaching the canthus.

In rabbits (Fig. 1) the glands of the lateral half of the superior eyelid are the more wider than the medial half, a feature which reversed for those of the inferior eyelid. It was observed that, the glands of both lids in rabbits are situated more coalescent and are formed of short and long types.

In cats (Fig. 2) the glands of both eyelids are equal in number. The glands in the superior is slightly wider than those of the inferior eyelid. Medially the glands of both lids reach both dorsal and ventral puncta lacrimalis, however they extend laterally to the lateral canthus. The glands are clearly separated from each other. The apices of some glands are curved. The glands of each eyelid are nearly equal in width and size.

In goats (Fig. 3) the glands of the superior are wider and larger in size than those of the inferior eyelid. The glands of the lateral two thirds of the superior eyelid are wider than those of the medial third. Some short glands are observed between the long ones specially at the lateral half of the

lid margin. The glands of the inferior eyelid are shorter towards the canthi and longer at the middle. Each gland in both eyelids is provided with a single circular orifice.

In sheep (Fig. 4) the meibomian glands of the superior are wider than those of the inferior eyelid. Those glands at the lateral two thirds of the superior as well as at middle third of the inferior eyelid are the most widest. It was also observed that, the apices of some glands are bifurcated.

In cattle (Fig. 5) the glands of the superior are larger and wider than those of the inferior eyelid. At the superior eyelid, many of the apices of the glands are branched. Each gland is provided with a single circular orifice.

II) Histomorphological features:

In rabbits the meibomian gland is located at the palpeberal surface of the eyelid and is largely spearated from the cutaneous surface by the orbicularis oculi muscle (Fig. 7). The glandular end-pieces vary markedly in size and present a weak holocrine activity. The duct is relatively narrow.

In cats the meibomian glands are pecularily separated from each other by interglandular connective tissue spaces (Fig. 8). Each gland is completely surrounded by a well developed tarsus. The glandular tubules are relatively small and show few variations in size. The glandular activity is moderate. The duct is relatively narrow.

In goats the meibomian gland is more or less large in size (Fig. 9). The glandular tubules are relatively abundant at the cutaneous surface of the gland. The glandular end-pieces vary obviously in size, the alrger tubules are mostly observed on the cutaneous side of the gland. The holocrine activity of the tubules is relatively inconspicuous. The duct is relatively narrow.

In sheep the meibomian gland is relatively larger than that of goats (Fig. 10). The glandular end-pieces are evenly distributed on both surfaces of the duct. The holocrine activity could be observed in most of glandular tubules, specially at the regions of the cutaneous surface and the base of the gland. The duct exhibited a marked dilatation before it opens at the mucocutaneous junction. The tarsus is relatively thin at the cutaneous surface and grdually increases in thickness towards the palpebral surface of the gland.

In cattle the meibomian gland is large in size (Fig. 11). The glandular end-pieces are large and separated from each other by thick septa specially at the cutaneous surface. The holocrine activity of the tubules is relatively obvious. The duct of the meibomian gland presents a relatively regular wide diameter.

DISCUSSION

According to the description of MARSHAL, PARKER and HASWELL (1982) a series of meibomian glands are found in the eyelids of mammals a result which was proved in rabbits, cats, goats, sheep and cattle. The meibomian glands are recorded also in the eyelids of dogs (ROBERTS, 1960 and MILLER CHRISTENSEN & EVANE, 1964), horses and ruminants (PRINCE; DIESEM; EGLITIS & RUSKELL, 1960 and DIESEM, 1975), donkeys and buffaloes (TAHA, 1990), rats (LEESON, 1963). However, in the camel the meibomian glands could not be detected either anatomically or histologically (TAHA, 1990).

The present work indicated that, the meibomian glands of all of the studied animals are not associated with hair a result which was observed by TAHA (1990) in buffalo.

The long axis of the meibomian glands, in the present study, is perpendicular on the free margin of the eyelid. Similar result was recorded in horses (TAYLOR, 1965), donkeys (TAHA, 1990), buffaloes (PRASAD and SINHA, 1979 and TAHA, 1990) and sheep (DIESEM, 1975).

The present work indicated that the meibomian glands of the animals under investigation can be differentiated from each other by many features. These features include number, width, size, density, distance between the glands and the extension of the glands along the free margin of the lid.

The number of the meibomian glands of rabbits is relatively similar to those of horses (PRINCE et al., 1960). This number is slightly more than that observed in donkeys (TAHA, 1990). The number of the meibomian glands in cattle is lesser than those of donkey and more than those of buffalo (TAHA, 1990).

The number of the meibomian glands in cats is about 64 in comparison with that recorded in dogs (40) (ROEERTS, 1960). Horses and rabbits have the largest number of meibomian glands followed by donkeys, dogs, cattle, cats, sheep goats and buffaloes (PRINCE et al., 1960; DIESEM, 1975; TAHA, 1990; ROBERTS, 1960 and MILLER CHRISTENSEN & EVANS, 1964).

The number of the glands of the superior eyelid is about 41, 36, 31, 34 and 30 in rabbits, cattle cats, sheep and goats respectively. This number is about 40–50 in rabbits (PRINCE et al., 1960), 45–50 IN HORSES (DIESEM, 1975), 28–38 in cattle (NICHOLAIDES et al., 1981), 40 in dogs (ROBERTS, 1960), 47 in donkeys and 25 in buffaloes (TAHA, 1990). Therefore, the number of

the meibomian glands of the superior eyelid is the largest in donkeys and horses followed by rabbits, cows, dogs, sheep, cats and goats, but in buffaloes the superior eyelids have the fewest number.

The gland of the inferior eyelid reach about 38 in rabbits, 31 in cats, 28 in cattle, 25 in sheep and 22 in goats, about 24 in donkeys, 20 in buffaloes (TAHA, 1990); 30–35 in horses (PRINCE et al., 1960); 19–30 in cattle (NICHOLAIDES et al., 1980) and 40 in dogs (ROBERTS, 1960). Consequently rabbits, dogs, cats and horses have the largest number of meibomian glands in the inferior eyelid among the domesticated animals followed by cattle, sheep, donkeys, goats and buffaloes.

According to the present study, the meibomian glands in each eyelid extend medially to the level of the corresponding punctum lacrimale, a result which is similar to that recorded in donkeys and buffaloes (TAHA, 1990). However, the extension of the gland laterally is variable among the studied animals. The glands of both lids in rabbits and cats in addition to those of the superior eyelid in cattle, sheep and goats extend to thc lateral canthus. On the other hand, those of the inferior eyelid of cattle, sheep and goats are stopped before reaching the lateral canthus. The glands of the superior and inferior eyelids in donkyes resemble thoe of ruminants (TAHA, 1990). PRASAD and SINHA (1979) and TAHA (1990) found that, in bufaloes the glands of both lids are absent near the lateral canthus.

As the meibomian glands are absent near the lateral canthus of the inferior eyelid in cattle, sheep and goats, the full thickness eyelid resection at the lateral canthus is recommended for correction of senile or congenital to decrease destruction of the meibomian glands.

The histomorphological features of the meibomian glands in rabbits, cats, goats sheep and cattle revealed by the present study agree with the description of PRINCE et al. (1960) and BANKS (1981) in these regards.

The holocrine activity of the meibomian glands in the animal species studied in this investigation varied, reaching its maximum in sheep and goats. These glands give off a sebaceous secretions which lines the lid margins, and due to its more viscous nature prevents the overflow of the more watery fluid from the lacrimal gland (PRINCE et al., 1960). This sebaceous substance creates an oily layer on the surface of the tear film. This helps to prevent rapid evaporation of normal tear lather (JUNQUEIRA et al., 1989). The present study revealed that, the duct of the meibomian gland of rabbits, cats, goat are relatively narrow, a matter which may prevail their obstruction resulting in Chalasion.

REFERENCES

Banks, W.J. (1981): Applied Veterinary histology Edition for 1974 published under title: Histology and comparative organology: a text–atlas. Williams & Wilkins, Baltimore, London.

Diesem, C. (1975): Equine, ruminant, Pig and carnivores sense organ and common Integument in Sisson and Grossmans. The anatomy of the domestic animals.

Drury, R.A>E. and Wallington, E.A. (1967): Carleton's Histological technique. 4th Ed. Oxford–Uni. Press. New York and Toronto.

Junqueira, L.C.; Carneiro, J. and Kelley, R.O. (1989): Basic Histology 6th Edition. A lange medical Book Los Altos, California.

Leeson, T.S. (1963): Tarsal (Meibomian) glands of the rat. Brit. J. Ophthalmol. 47(10): 222–231.

Marshall, A.J.; Parker, T>J. and Haswell (1982): Text book of Zoology Vertebrates. English language blook society and Macmailan.

Martin, C.L. and Anderson, B.J. (1981): Occular anatomy in text book of Veterinary Ophthalmology by K.N. Gelatt. Lea & Febiger, Philadelphia.

Meibomius, H. (1966): Cited by Leeson (1963).

Miller, M.E.; Christensen, G.C> and Evans, H.E. (1964): Anatomy of the dog. W.B. Saunders company. Philadelphia.

Moustafa, M.N.K. (1982): Histological and Histochemical studies on some mucocutaneous junctions in the Egyptian Buffalo. M.V.Sc. Thesis. Fac. Vet. Med., Assiut University.

Nicolaides, N.; Kaitaranta, T.N.; Rawdah, J.I.; Macy, F.M.; Doswell and Smith, R.E. (1981): Meibomian gland studies: comparison of steer and human lipids Invest. Ophthalmol. Vis. sci., 20(4): 522–536.

Prasad, R. and Sinha, R.D. (1979): Histological and cartain histochemical studies on sebaceous glands and their modifications in the eyelids of the indian buffalo (Bubalus bubalis). Indian Vet. J. 56(8): 672–674.

Prince, J.H.; Eglistis, C.D. and Ruskell, G.L. (1960): Anatomy and Histology of the Eye and orbbit in Domestic animals. Charles C. Thomes publisher, Spring–field, Illinois.

Roberts, S.R. (1960): Congenital posterior ectasia of the sclera in collie dogs.

Sar, M. and Calhoum, M>L> (1966): Microscopic Anatomy of the integument of the common American goat. Am. J. Vet. Res., 27(117): 444–456.

Strickland, J.H. and Calhoun, M.L. (1963): The integumentary system of the cat. Am. J. Vet. Res., 24: 1018–1029.

Taha, M. (1990): Surgical anatomical studies on the appendages of the Eye in camel, Buffalo and Donkey. Ph.D. Thesis. Faculty of Vet. Med. Assiut Univ.

Taylor, J.A. (1965): Regional and applied anatomy of the domestic animals. part I, Head and Neck. Oliver and Boyd. Edinburgh: Tweeddala court. London.

LEGENDS

Fig. 1–5: Cleared palpeberal conjunctive of the superior and inferior eyelids of 1– rabbit, 2– cat, 3– goat, 4– sheep and 5– cattle, showing:

A) Meibomian glands of the superior eyelid.

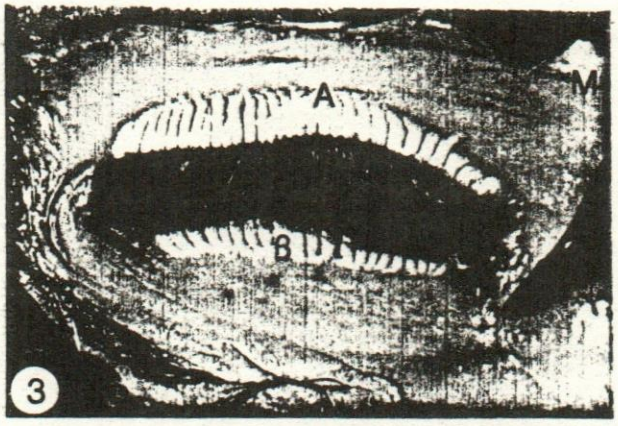
B) Meibomian glands of the inferior eyelid.

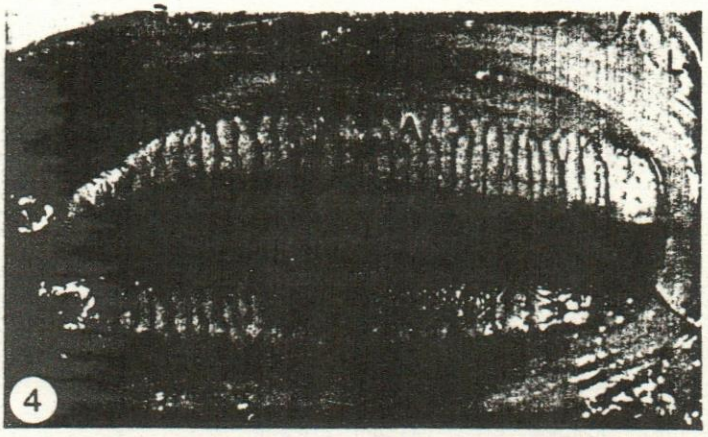
(M= Medial, L= Laterl).

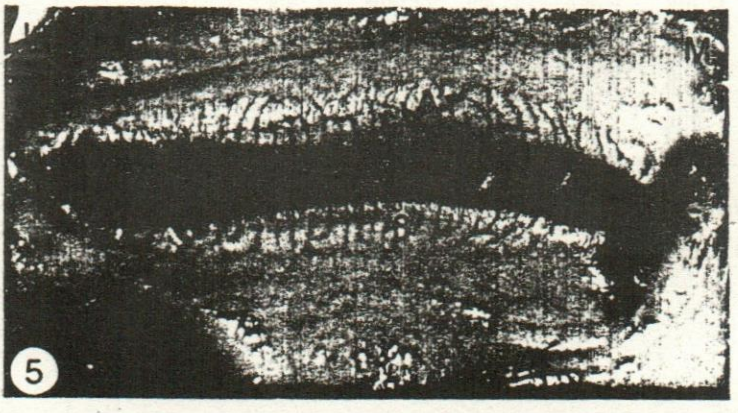
Fig. 7–11: Histological sections in the meibomian glands of 7– Rabbit (X 6.3), 8– Cat (X 6.3), 9– Goat (X 4), 10– Sheep (X 4) and 11– Cattle (X 4): PS= Palpebral surface.

CS= Cutaneous surface.

Stain: Haematoxylin & Eosin.


A
B
3


4


5

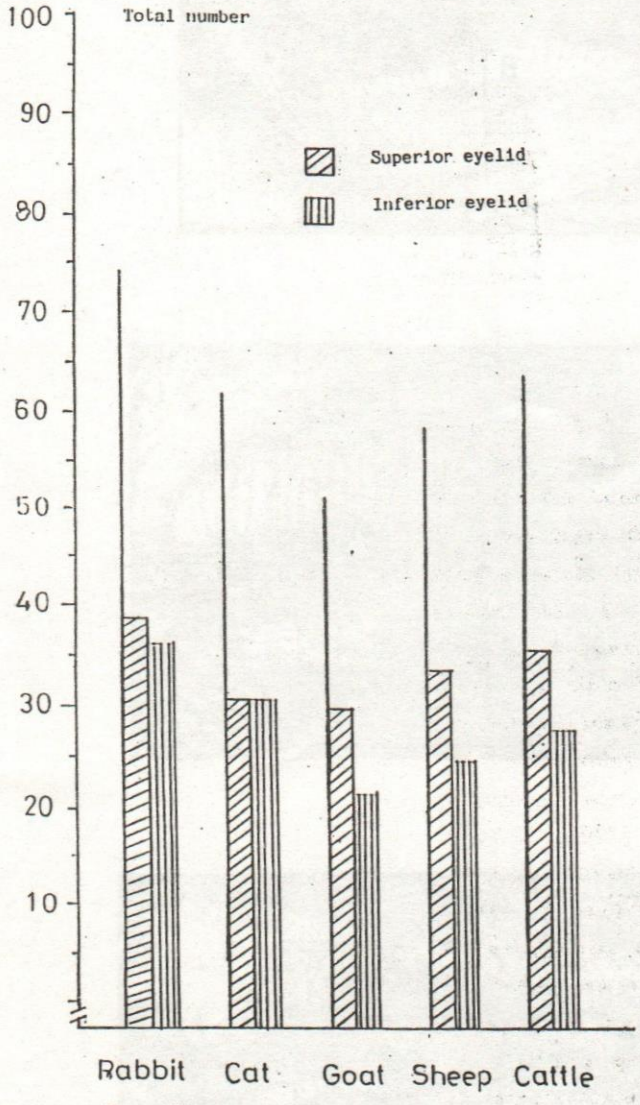
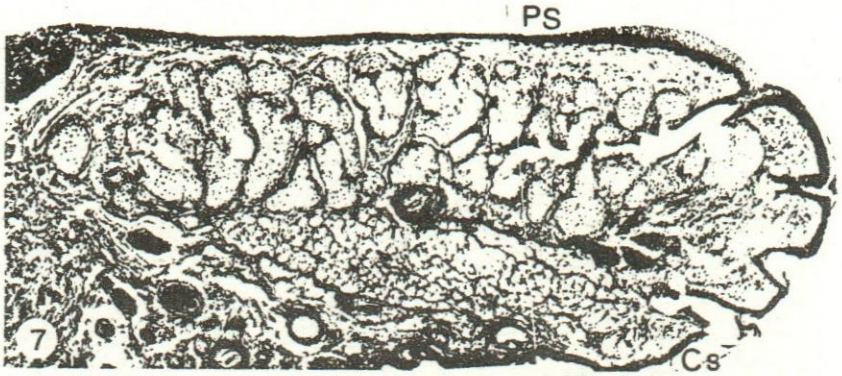
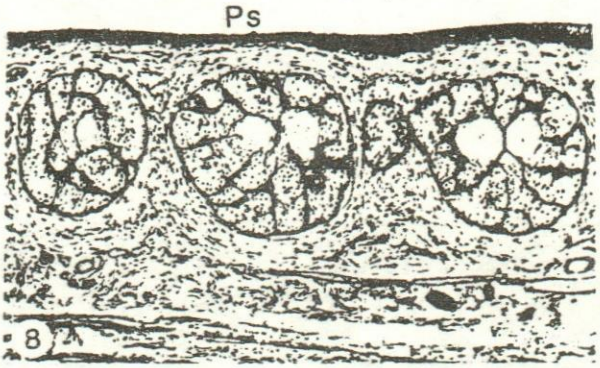
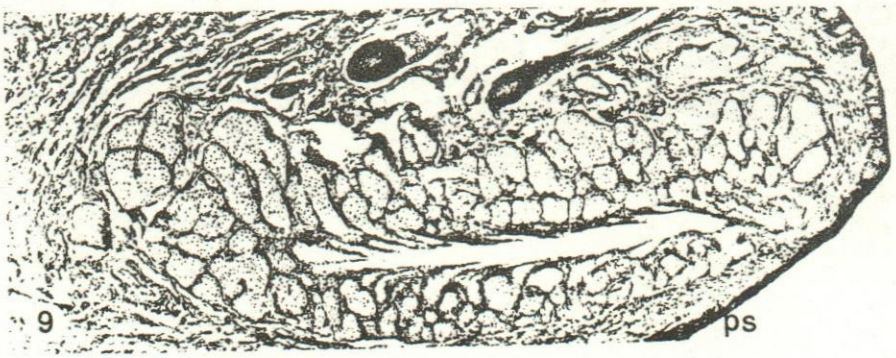
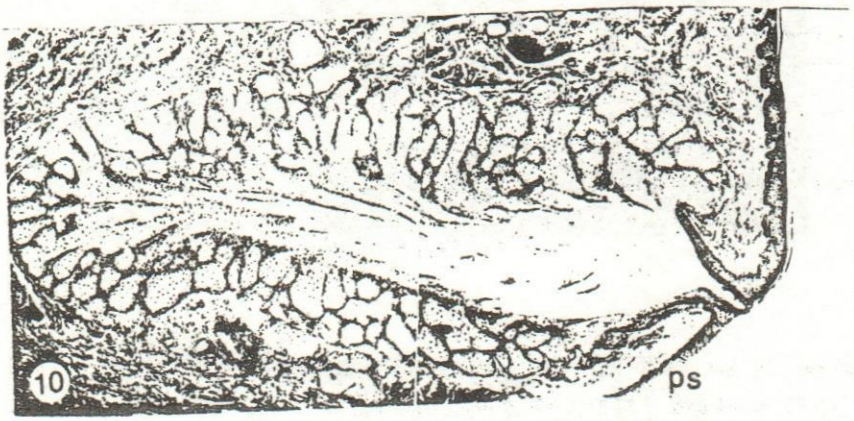


Fig. (6): Meibomian glands number in each and both eyelids of rabbit, cat, goat, sheep and cattle.


PS
7
Cs


Ps
8


9
ps


10
ps


ps
11
cs