



GCCF

Korat & Thai Breeding Policy



Contents

1. Breed origins and history (including the origins of colour and pattern)	3
2. Breed Genetic Diversity (with reference to studies made by Dr Leslie Lyons & her team at UC Davis, California)	6
3. Breeding Practice	8
A. Importing	
B. The selection of suitable mates	
C. Improving type, colour and pattern	
4. An explanation of the current GCCF Korat & Thai registration policy	11
5. The gangliosidosis testing scheme	12
6. Other health factors	12
7. Identification of a potential outcross (the worst case scenario)	14
8. References & acknowledgements	14



Breed Origins & History

In the west the Korat takes its name from a northern area of Thailand, a remote location near the Burmese border. It's believed blue cats may have had the evolutionary edge there as the coat colour blended with the granite rock. In its homeland it's most usually called the Si-Sawat, though there are also the older names of Doklao and Maled. These derive from the poetic imagery of the Tamra Maew, Thailand's treasured 'Book of Cats' now to be seen as the Smud Khoi of Cats in the National Museum of Bangkok.



The Korat drawing and verse as it appears on the ancient manuscript (Smud Khoi)

Naturally enough, it is how the cat looks (phenotype) that is described with the body colour being likened to a seed head, lemon grass flower, clouds and sea foam, but they are important as they are the reason for the Korat's modern Thai name of Si-Sawat (grey cat - where si is colour and sawat a mingling of grey and light green). Thus when the Korat was imported into western cat fancies it was defined solely as a blue cat with Thai confirmation that if it wasn't blue it couldn't be a Korat.



It is only a blue cat that is used in the ancient Rain Ceremony when a Korat is carried in procession to the village well and much noise is made to encourage the development of clouds coloured as its coat. It is blue cats that are given as wedding gifts and commemorated on postage stamps. A cartoon version of a Si-Sawat kitten was also the logo for the 2007 South East Asian Games.

However, to name a cat for coat colour can cause a problem when it doesn't always produce kittens that are blue. Genetically blue isn't a colour. Its symbol is 'd' for dilute and it is what modifies a black coat to make it appear lighter to human eyes. However, a blue cat may carry genes recessively that alter appearance further and this proved to be the case with Korats.

Some were dd/CC (C denotes solid colour) and others dd/Ccs (cs is the siamese pattern). When kittens inherit cs from both parents and are dd/cscs then they have the siamese pattern and will be blue pointed rather than solidly blue.

Note: the coat pattern siamese is named after the breed Siamese, but a cat that has this pattern is not necessarily a Siamese cat.

A few Korats carried b (brown) and so were db rather than dd. As long as db x dd matings were done only blue kittens appeared, but when accidental or intentional breeding of close relatives occurred then db/db kittens were born, and dilute in conjunction with brown gives the pinky beige coat known as lilac or lavender in fancier terms. As yet no lilac pointed kittens have been born (db/db cs/cs) though it could happen. Some Korats are known to carry both recessive genes, but as yet no breeder has wanted to develop the combination of pattern and colour, although the registration policy and the GCCF computer program acknowledge the possibility.



New born Thai Blue Points with their Korat mother and a Thai Lilac kitten with his Korat siblings.

The appearance of both blue pointed and lilac kittens to blue Korat parents caused friction amongst breeders in the late 20th century. This centred around the belief that there had been outcrossing to other breeds to obtain the non-blue colour and pattern.

Blue Points occurred in the litters of the first Korats imported to USA (1959) as recorded in a chapter of "The Shorthaired Cat" written by Harriet Wolfgang (CFA Judge) who documented the early breeding records, and non-Mendelian genetic assumptions of the importer. From then onwards they made sporadic appearances, indicating the recessive to be wide spread. They occurred in litters born to the foundation Korat imports of 3 unrelated cats (one pregnant) into UK and onto the GCCF register in 1972.

This wasn't surprising as it was clear from the few Thai pedigree records in existence that Siamese x Korat was an accepted mating with the offspring named according to phenotype. Also, the western policy adopted was if a Korat produced a pointed kitten a different partner should be used subsequently which masked rather than eliminated carriers. Early UK breeders were encouraged by their US mentors not to register the pointed kittens, nor even mention their existence, as it could lead to difficulties getting Korats recognised.

The birth of the first lilac in UK provoked an almost hysterical reaction, though it was later verified that there had been CFA registration of 'lavender' kittens in 1964 and 1972. The first was almost certainly a pointed kitten (as blue eyes are mentioned), and may have been a blue point, but the second was definitely a solid coloured lilac kitten, produced from a mother/son mating of Thai born Korats by Mrs Eugenie Herr when she was living in Indonesia. She joked they should be called 'Djakarta Pinks'. A sibling of this male was later imported into UK (1979) and was grandsire and great-great grandsire of Jenanca Lilac Lillee whose birth caused such a commotion, but shouldn't really have been such a surprise.

What was different was that Lillee's birth marked the end of the secrecy that surrounded the non-blue offspring of Korats. New imports were made so that those who wished to do so could avoid lines that possibly carried chocolate. Two females from Thailand and a male from USA were subsequently also found to carry it, proving the pre-DNA testing maxim that recessives go on forever.

There was some speculation on the origin of the chocolate recessive, especially as there was a copper cat, Nam Larb, notated on one of the Bangkok Thai pedigrees (Chompoo's). However, although there's no knowledge about whether she was a solid coloured cat or one with Burmese or Tonkinese colour restriction, and if b was present in her genetic make up, there's no recorded connection between Nam Larb and Malakot who gave birth to the lilac in 1972. It is far more likely that chocolate was inherited from one or more of the several seal points or blue points in known Thai Korat ancestry, and it's possible that in the 1960/70s no distinction was made between seal and chocolate point anyway.

The Thais have no word for the lilac/lavender colour either. It would be rarely seen in a random bred population, requiring either two lilac parents or both adults to carry the necessary recessives. However, there are two interesting observations from Mrs Daphne Negus who visited Thailand to gather a selection of Korats to take back to USA as foundation cats for the breed. She saw a large male lilac cat who belonged to the breeder (Sundarodyan) who was a bookbinder close to the walls of the royal palace. Also, she learned that Mr Chompoo was keen on producing a solid lavender cat, (but presumably didn't have the necessary genetic knowledge). He couldn't realise his dream because he took a new wife who refused to live with so many cats and therefore his breeding career came to an abrupt end! When the most knowledgeable and prominent of the Thai breeders (Rouen Aphibal Rajamaitri, Mahajaya) was informed of the lilac born to Mrs Herr in 1972 she wrote that there should be no concern as throwbacks happened.

When genetic tests became available for colour and pattern via VGL at UC Davis in the first decade of 21st century they confirmed the existence of cs and b in the western Korat population, mostly where they were expected, though there were exceptions. There was one instance with b and more with cs where carriers were detected but the actual colour/pattern had not been reported. The frequency and widespread geographic occurrence made definite the presumption from the historic evidence gathered. The origin of the recessives was Thailand and predated selective Korat breeding in the west. There had been no covert outcrossing and the decision by GCCF breeders to refer to the non-blue offspring as Thai Blue Point and Thai Lilac was vindicated.

Genetic Diversity

In his BBC series on cats in the late 1980s Roger Tabor said that if the Siamese was the cat of royalty the Korat was the cat of the farmers. Mrs Johnson (first known importer to USA) was told they were the cat of the Siamese (Thai) people, but had to wait some years to obtain a breeding pair in 1959. According to tradition they were given as wedding gifts to bring good fortune, and were considered rare and lucky.

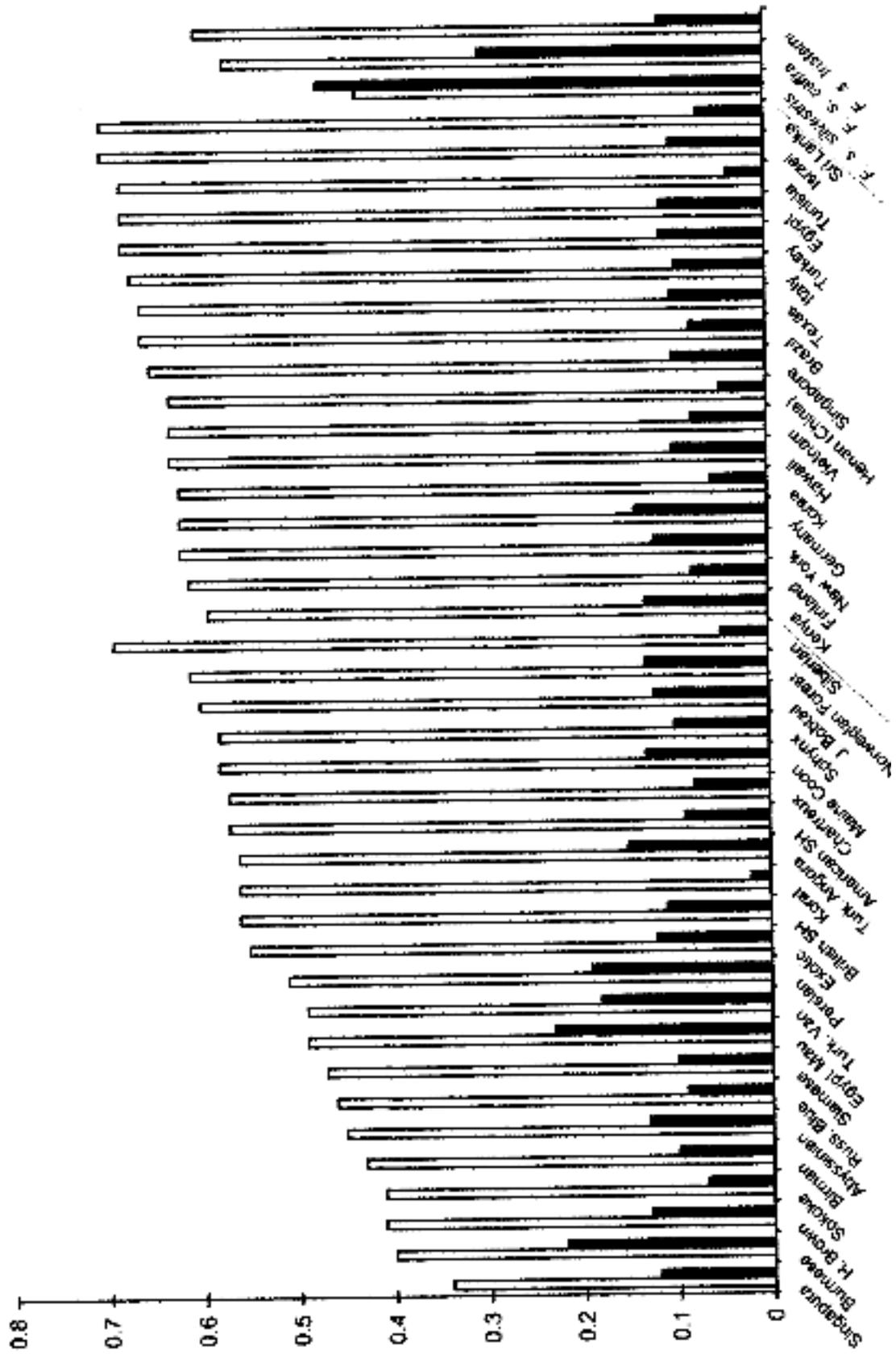
Until the western demand for cat breeds it's doubtful that there was any selective breeding in Thailand. The cats were named by looks and colour as they occurred in the domestic population, just as with UK domestic cats in the 19th century. So although the Korat phenotype was less common than many, their genetic background would be similar with possible restriction due to remote geographic location.

This and their relatively late introduction as a pedigree breed (1972 in GCCF) probably explains their good genetic diversity and low inbreeding coefficient scores as presented by research done at UC Davis by Monika Lipinski, directed by Dr Leslie Lyons.

Breeders are anxious to observe a policy of no outcrossing as the Korat is defined as the blue cat of Thailand and its genetic heritage is that particular to the South East Asian group of cats (Lipinski). The current evidence shows this is viable, thanks to early breeders who secured foundation cats from a variety of sources, geographical and type, rather than use only the Bangkok catteries emerging in the 1960s. Importing directly from Thailand is the best means of retaining diversity and is allowed for in the registration policy. Some Thai catteries are now registering with US based registries, but care should be taken to select lines that are new or distinctly different, even if there are non-registered cats in the pedigree and reference registration has to be accepted initially.



The UK's first Korat imports from USA in 1972
&
A Korat mother with her litter in Thailand
2010



On the chart light bars represent observed heterozygosity and the breeds are arranged in order with the lowest (Singapura) on the left (1), with the Korat 14 of 22 pedigree breeds listed. The darker bars denote the inbreeding coefficient and the Korat scores particularly well .

Breeding Practice

A Imports

Korat breeders are fortunate that UC Davis has taken a particular interest in the Korat, because being the first to screen for genetic disease, and so comfortable with submitting samples, plenty of genetic information was available (150 cats from across USA, UK and Europe). Also there was interest because it's unique being a tiny minority breed with such good genetic diversity. Therefore we have some golden rules to follow for sensible breeding as set out by Dr Lyons based on the studies of the UC Davis Team:
(headers and bullet points are quoted directly from lecture slides presented by Dr Lyons)

- continued use of mutation carriers

Limit inbreeding

- no over use of males or females
- wide sharing of males
- co-operation of breeders

Continued Migration

- Importation
(to include random bred cats from Thailand)
- Outcrossing
(to consider different breeds)

The mutation carriers referred to in the first section are those that carry cs, b or both. For breeders who work with Thais as well as Korats it would almost certainly be a standard part of the breeding choice to use Korats who DO carry because they have a non-blue parent. The message for those who want to produce only Korat kittens is not to discount carriers and so limit the available bloodlines. As long as the carrier status of each cat is known, and care taken to mate carrier to non-carrier, only blue kittens will be born.

The maintenance of diversity is of far greater importance than 'purity' which confers no positive benefits and is of aesthetic rather than genetic significance.

It's recommended that a panel of coat colour tests such as offered at VGL <http://www.vgl.ucdavis.edu/services/cat/> should be carried out before breeding from imported cats from Thailand, so that it's known which recessives are carried, if any. Those we have (cs & b) are the most likely to be present, which would make the new line interesting for Thai Lilac and/or Blue Point breeding too.

There's also just a chance that cb (the mutation that gives the Burmese pattern) could be there, and a very remote possibility of ca (recessive white) that causes albinism. Neither of these should be spread in the Korat gene pool, but it's perfectly acceptable to use carriers for breeding and then select clear kittens for the active register for the next generation, in exactly the same way if working to avoid having non-blue progeny.

B) Selection of suitable mates

Let's be realistic. It will be only a few breeders of any generation that have the facilities and finances to import. Working in partnerships can help, but make sure everything is on paper in advance so that all parties know what to expect from the others. Friendships have come to grief over this in the past. If you know that as yet you don't have the experience or resources to import, then you have the responsibility of taking care not to inbreed. Don't keep using the same cats. Be prepared to retire, neuter and rehome breeding cats, even those who have done well. It's not good for the breed for one cat to have his/her genetic input repeated to the exclusion of others. Far better for there to be a pool of shared males.

This also helps novices get started. If someone purchases a kitten with an interest in breeding, avoid pointing the newcomer to her uncle or grandfather as a potential future partner. Nobody should be tied to the use of one or two catteries. Restrictive contracts of the sort where one breeder wants to control what another is doing with kittens s/he produces are also not conducive to breed health. It's very difficult for novices to obtain suitable breeding cats and stud services in some of the most popular breeds, for what would seem to be business purposes masquerading as 'welfare'. Such practices would cripple a minority breed. It pays for breeders to work together to support one another and provide access to give choice in breeding.

Some breeders like to make use of coefficient calculations to determine how closely related two cats are to each other prior to mating. To do this knowledge of ancestors is essential, with 8 generations recommended, but at least 5 needed. Detailed guidance on selection to be aimed for is given in the GCCF Breeding Policy page 5. If you have 'Breeders Assistant' this is relatively easy as the program does it for you. Use can also be made of the Korat data base at Pawpeds to consider potential pairings, or the suitability of an import: <http://www.pawpeds.com/db/?p=kor&date=iso>

Note: If making comparisons with another breeder make sure you are both using the same program which is on the same setting, or it will be as pointless as comparing apples with oranges.

The following quote from Professor Bateson's report into dog breeding provides sound advice to novice breeders, and is for all to bear in mind:

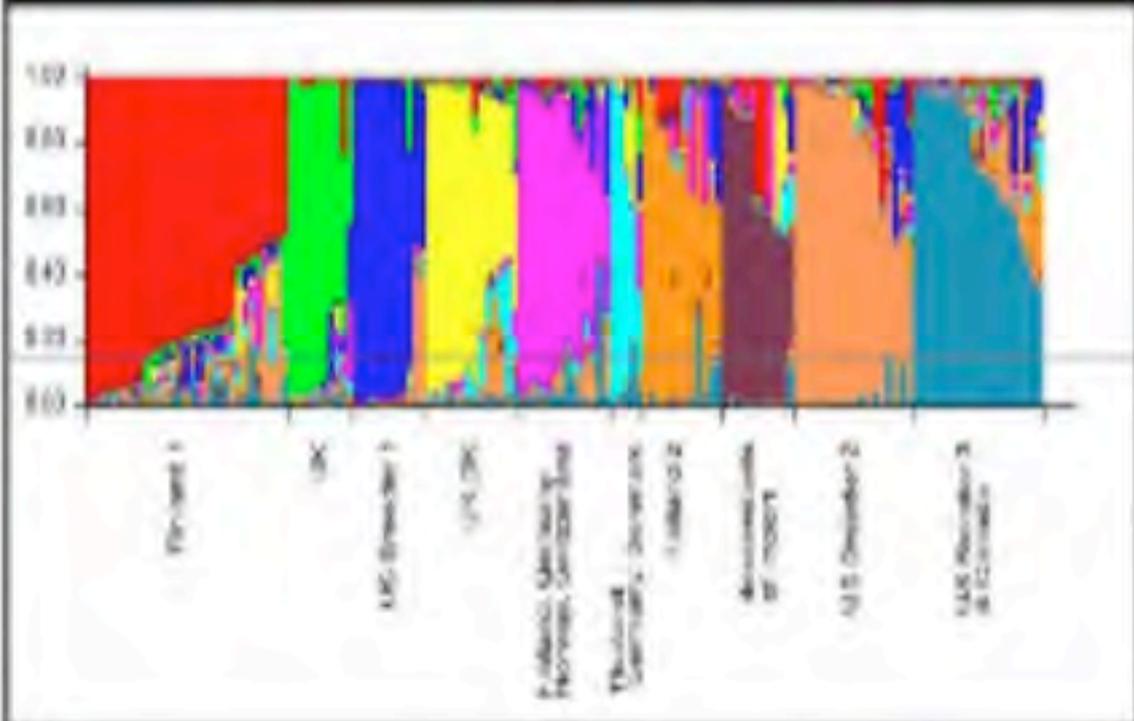
Avoid very close inbreeding. Granddaughter mated to grandfather is too close in my view. A good rule of thumb is that if the pedigrees of the potential mates include more than two (common) grandparents, avoid that mating.

The KCA AGM suggestion of kittens from very close matings being excluded from active registration, unless there are special circumstances, is now accepted as breeding policy and may become a rule at the next Council meeting.

C) Improving type, colour and/or pattern

This is of less importance to genetic diversity (breed health) and sound general health. Most Korat and Thai kittens are destined for pet homes, rather than for breeding and the show bench, and should be active and robust, not frail or delicate. Also, Korat kittens are not mini adults.

Korat Sub-structures



Importing from other western Korat breeders will not provide quite the same level of outcross as new far eastern lines, but is always useful. The chart produced via work at UC Davis shows clearly by colour (apologies for the poor print reproduction) that the various countries, and even particular breeders within a country, have developed distinct substructures of breeding lines. Finland's (on the left in red) have imported considerably recently to stimulate diversity and that is apparent. Our cats are represented in green (next to Finland) and also in a Danish cattery (yellow).

They are often darker, not so smooth coated, and have a narrower head and smaller eyes than a quality show bench Korat or Thai. It's very rare for a Korat kitten to be a high flier in any organisation.

So careful consideration should be given to the parents of any future litter. Do they complement each other? Doubling up on any weakness - such as yellow eyes- is not recommended. Take care also to avoid doubling up on minor coat faults, such as white hairs or visible tabby markings.

As the Thais are from many generations of Korat breeding there has been no problem with their type. To improve on colour and pattern at least one parent should be Thai in preference to relying on the progeny of 2 Korat recessive carriers. The lilac coat colour has received wide approval from judges for its warmth and evenness. Those qualities should be retained whilst aiming for more silvering. The Blue Point pattern is not yet fixed in colour, though it has improved in recent generations. Eye size and colour in both types of Thai have been good and must not be lost.

Some Korats and Thais have coats that show tarnish or rustiness, giving the blue or lilac a browner tone, sometimes in patches. A combination of sunbathing and grooming (saliva) can make it more apparent in the summer and when queens are feeding kittens. It seems to occur more frequently in some lines than others, suggesting a genetic predisposition, so it's a factor to bear in mind when selecting a mate.

What it most definitely is not is any indication the cat concerned carries b. It happens to the coats of recessive carriers and non-carriers equally. There's the same frequency of problem in USA (scarcely any carriers) as here. There is only one way of detecting whether a Korat carries cs and/or b and that's DNA testing in a reliable laboratory, or they would have been selected against long ago. Carrying a recessive has no impact on the appearance of a blue cat, nor its health or temperament. It's entirely irrelevant to show bench achievement.

An explanation of the current registration policy

When the present registration policy was put together it had 3 objectives:

- to protect the breed**
- acknowledge the Thai Lilac and Thai Blue Point and give them identities**
- to provide breeders with information to make choices**

It ensured that the offspring of any breed other than Korat and Thai, whether pedigree or not, could never be registered as a Korat. The only only unregistered cats to be allowed onto the register are Korats with proof of origin in Thailand (see importing).

In the future it would help if these cats could have Genetic rather than Reference Registration to encourage breeders to bring in and work with imports that could have immediate showbench evaluation.

The Thai Lilac and Thai Blue Point are now at provisional level. Once they attain championship status they move to the Full Register and a decision will have to be made about the registration of Korats and Thais born to Korat x Thai mating. The retention of use of the Supplementary Register would distinguish them from the offspring of like to like. It will be a decision for KBAC to make at that point.

When they received breed status it was thought they would eventually stand alone from the Korat. Genetic knowledge has moved on since then, and it's now clear to isolate them with a limited gene pool would be extremely detrimental for their development and the Korat would not gain in any way.

Overstamping for carriers and possible carriers of the recessive genes gave breeders information on which to make choices. This can now be done far more reliably by genetic testing and it's possible to have overstamping removed with test evidence if so wished. In any revision of the policy testing recommendations and results provided could replace overstamping. The necessity for microchipping to provide definite ID for test results is already in place.

Gangliosidosis Testing Scheme

The second part of the registration policy is the gangliosidosis (GM) testing scheme. In the late 1990s there was positive diagnosis of two forms of GM in Korats. One (GM1) is shared with the Siamese (another pointer to common ancestry) and the other (GM2) is unique to Korats. Because GM occurs in other species, including people, genetic tests for the fatal mutations were devised fairly speedily by Dr Henry Baker whose area of expertise in veterinary medicine this was.

All UK GCCF lines tested clear and the registration policy was written to ensure that any imports onto the register needed to provide evidence of status for both forms of GM. However, should a carrier be imported it can be on the Genetic Register to designate its risk, but can be used by breeders with cleared cats to obtain clear offspring to ensure an input into the gene pool is not lost.

***** Consideration should now be given to a revision of policy to ask that all new cats imported onto the register should be tested rather than rely on documentation that may now be over 10 years old with ever increasing opportunity for pedigree records to be inaccurate.

Other Health Factors

Other problems recorded in Korat breeding are:

- flat chested kittens (fck) occasionally,
- asthma occasionally (noted in some cats in mid life, possible inherited predisposition)
- tail faults
- umbilical hernias
- kittens born with twisted legs and feet
- squints (oscillating nystagmus) (Thai Blue Points only)

A few fck kittens have not survived, most recover to lead a normal life. ALL of those with twisted legs or feet have had no issues after the first few weeks. The photos of before and after for this anomaly were supplied by a Canadian breeder. Although tendon restriction seems self correcting it is not recommended that an affected cat is bred from (same with a recovered fck kitten, or one who has had a hernia repaired.) To breed from a cat affected with such a condition would vastly increase the risk of the genetic predisposition responsible being passed to the next generation.



Kitten at birth and normal at 5 months.

Veterinary scientists recommend repeating a mating to see if a condition reoccurs (see FAB 'What to do if your cat has a deformed kitten') in an attempt to determine whether the defect is an inherited or developmental abnormality.

http://www.fabcats.org/breeders/info_sheets/breeding_from_your_cat/deformedkitten.html

It's acceptable if quality of life for an affected offspring is not unduly compromised. If a a Korat produces the same defect on 2 occasions with different partners then a removal from breeding is recommended, particularly for a male. This also is a sound premise for the parents of FIP succumbing kittens. Prof Tim Gruffydd-Jones described it as a 'two strikes and you're out policy'. There's little point in risking an increased chance of more of the same when kitten health is of prime importance above all else.

**It's important that breeders should share knowledge when defects and disease occur.
These things are not anyone's fault.**

On the plus side Korats and Thais are not extreme in any way. From anecdotal reports over 50 years of western breeding it would seem that they have a good record of longevity. Many pass 15 and a fair number go into their twenties, That's quite an achievement for a breed that is on record as having the lowest birth weight in litters (Bristol University and FAB survey 1998)

The 'Magnificent 7', born by caesarean one Christmas Eve.

Mother took care of them once they were home and all survived,



Identification of a Potential Outcross

Accepting Dr Lyons's information from UC Davis as the best indication we have to date it would seem there are no difficulties continuing without making an outcross to another breed. If this became impossible by reason of import ban, genetic disease or inbreeding depression being diagnosed by suitably qualified specialists, then the Khao Manee, as another breed native to that part of the world, could provide new blood lines. If non-white variants of this breed are available in a solid colour they would be very much more preferable. The Korat's other SE Asian cousins are the Siamese and Burmese, but their breeding programmes have included the introduction of western cats at times and also care would have to be taken to avoid any of their known breed health problems. However, it's hoped the Korat & Thais remain viable as ancient natural breeds for the indefinite future. Their unique Thai background must be prized, and any deviation undertaken only with the guidance of experts for the purpose of preserving health.

References:

Dr Leslie Lyons, Associate Professor of Genetics at University College Davis, California
The Ascent of Cat Breeds - M Lipinski et al 2008
Robinsons Genetics for Cat Breeders and Veterinarians - C. Vella, L Shelton et al
Feline Advisory Bureau - information for breeders - <http://www.fabcats.org/>
Independent Inquiry into Dog Breeding - Prof Patrick Bateson
A Trip for Nine Korats and The Korat Story - L. Daphne Negus

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Useful web references:

<http://www.gccfcats.org/index.html>
<http://www.korats.org.uk/>
<http://www.pawpeds.com/db/?p=kor&date=iso>
<http://www.vgl.ucdavis.edu/services/cat/> (coat colour/pattern & parentage testing)
<http://www.laboklin.co.uk/laboklin/GeneticDiseases.jsp?catID=CatsGD> (GM testing)
<http://www.fabcats.org/>
<http://www.koratworld.com/>