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Wild Pigs (*Sus scrofa*)-A Missing link in Ecology Conflict, Crisis and Conservation

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Abstract

Over the past few years, much emphasis has been given to the studies related to conservation, especially, to those that are non-invasive that measure glucocorticoids as bio markers of stress. Glucocorticoids typically increase in response to challenge and are sometimes used to predict mortality. These levels reveal fitness of an individual in terms of survival and reproductive success. The study was carried out to assess the faecal cortisol concentration in order to arrive at the baseline values pertaining to stress factors in wild pigs entering the agricultural fields around the forest regions and in domestic pigs comprising of desi pigs and cross bred pigs. The adjoining areas of Mudumalai wildlife region, Sathyamangalam wildlife region and Anaimalai wildlife region of Tamil Nadu, India were included in this study programme. The mean faecal cortisol concentration in the case of wild pigs that entered these areas were found using ELISA (Enzyme Linked Immuno Sorbent Assay). The wild pigs are always in conflict with agricultural production and cause unequalled damage. The occurrences of wild pig-human conflicts were also assessed. The findings demonstrated that fecal glucocorticoid assays provide an index of physiological stress in wild pigs and may prove useful in addressing conservation and conflict issues. To know the ecological and functional position of wild pigs in the ecosystem is very important as these animals are habitat generalists, prolific breeders and survive in almost any environment, of late these animals have been involved in a huge conflict with the humans especially pertaining to agricultural holdings. This paper aims at finding the triggering, corresponding and confounding factors that cause these pigs to wander into buffer areas and agricultural fields instead of forest regions causing disruption in the ecological equilibrium and ultimately ending up in conflict more severe than the previous one.

Keywords: Wild pigs; Cortisol; ELISA; Conflict; Conservation

Introduction

Non-invasive techniques have the advantage of keeping subjects undisturbed during collection of samples which help to fix baseline values [1]. Hormonal studies are currently being incorporated in wildlife research as a means to evaluate the health and physiology of individuals [2]. Wild pigs are animals that are habitat generalists and they survive in a wide range of adverse conditions without losing their prolificacy. Of late these animals have been seen wandering into human inhabitations and have started to co-exist sharing the same resources [3]. The wild pigs have been least tolerated because of their constant crop raiding activity throughout the year. This brings them into conflict with the humans, who retaliate to these animals by a most common method of poisoning. This has tragic circumstances when the balance is altered and the apex predators are washed out by either direct or indirect toxin uptake [4]. Farmers lose over 50% of their produce because of wild pigs by direct or indirect losses. The factors that drive them in an unpredictable manner have to be pointed out; therefore, assessing their stress quotients become pivotal. Due to the fact that stressful events have potential deleterious effects on animal reproduction and immune systems, it is of special concern to monitor the stress response in free-ranging animals. Further, weather is not the only source of unpredictable events. Other examples include sudden changes in social status, increased predator numbers, decreased food resources, and disease. Animals use environmental cues such as changing day length, temperature and rainfall to predict future events and adjust accordingly. However, responses to short lived perturbation factors require more rapid responses without the possibility of anticipatory changes. This response has been collectively termed "the emergency life history stage" and serves to direct the individual away from normal life history stages into a physiological and behavioral state that will allow survival in the best condition possible [5]. Glucocorticoid metabolites are always excreted in feces, but the amount of different glucocorticoid metabolites varies between species [6]. Early diagnosis of physiological changes may allow conservation and effective conflict management strategies. Noninvasive monitoring of the stress response of wild pigs might help to evaluate the factors that cause stress and in turn triggers them to fall into conflict with humans.

Materials and Methods

The study area

This study on faecal cortisol in wild pigs (*Sus scrofa*) interfering with agriculture was carried out in areas adjoining the Western Ghats (Mudumalai tiger reserve, Anaimalai tiger reserve) and Eastern Ghats (Sathyamangalam region) of Tamil Nadu state in India during November, 2013 to May, 2014.

Number of samples examined

Fresh fecal samples were obtained from free-ranging wild pigs [7] in agricultural fields of adjoining forest regions of Mudumalai,

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Sathyamangalam and Anaimalai (Table 1). Throughout this study period, faecal samples were collected followed by thorough mixing of the freshly voided wet fecal materials and these were stored in 80 per cent methanol [8] for steroid extraction pertaining to the estimation of cortisol.

Well-mixed wet feces (0.6 g) was placed in a capped tube, containing 2.00 ml 80 per cent methanol, vortexed for 30 minutes and then the tubes were carefully centrifuged for 20 minutes at 2500 rpm. The supernatant material was diluted in Phosphate Buffer Saline and stored at -80°C for subsequent use. Cortisol estimation was done using the ELISA KIT-DSI-EIA [9]. The faecal samples of wild pigs obtained from adjoining areas of Mudumalai, Sathyamangalam and Anaimalai wildlife regions were processed and subsequently subjected to estimation of cortisol concentration by using the ELISA kit (DSI-EIA- STEROID-CORTISOL EHE-151). Using the ELISA reader, the absorbance values of standards as well as the samples were analyzed and the standard curve was obtained using standard techniques. The calibration curve with the mean absorbance on Y-axis and the calibrator concentration on X-axis was obtained using a 4- parameter curve by immuno assay software. The value of cortisol concentration of the unknowns was read directly from the calibration curve (Figure 1).

Collection of meteorological parameters and conflict

The details of the meteorological parameters of each region were obtained from the Tamil Nadu Agricultural University (TNAU) portal. These meteorological parameters were ascertained to have direct or indirect effects on the wild pigs like seasonal migration, water availability, rainfall and radiation. The wild pig-related conflict areas in the adjoining regions of Mudumalai Sanctuary were identified subsequent to the discussion with forest veterinary officer, officials of the forest department, villagers and other village level officers. The level of conflict pertaining to the three regions under study were recorded and correlated with the meteorological factors and the cumulative stress. Conflicts were graded as low, moderate and high.

- Low-infrastructure damage, water source contamination, rooting of land and ecological damage
- Moderate-agricultural crop raiding, livestock preying, damage to forest restoration and grasslands
- High-injury to humans, causing fatalities

Statistical Analysis

The statistical analysis of the data was carried out as per the guidelines furnished by Snedecor and Cochren [10] using one way ANOVA, Chi square tests.

Results

Faecal cortisol

The faecal cortisol level in samples of wild pigs, desi pigs and cross bred pigs are listed in Tables 2-4. The mean concentration of cortisol in faecal samples obtained from wild pigs, desi pigs and cross bred pigs were also compared statistically (Table 5) in each of the adjoining areas. Highly significant ($P \leq 0.01$) variations were encountered among the wild pigs, desi pigs and cross bred pigs in each of the adjoining areas of Mudumalai, Sathyamangalam and Anaimalai respectively. The mean faecal cortisol concentration in desi pigs however differed significantly, when compared to the mean faecal cortisol concentration in cross bred pigs. The statistical analysis revealed absence of variations between the wild pigs of all the three different adjoining areas (Table 6). However, highly significant variations ($P \leq 0.01$) were encountered in the faecal cortisol concentration of desi pigs at adjoining areas of Sathyamangalam, when compared with the faecal cortisol level in desi pigs at adjoining areas of Mudumalai and Anaimalai. Highly significant ($P \leq 0.01$) variations were noticed among the faecal cortisol concentrations in case of cross bred pigs of these areas.

The mean over all faecal cortisol level in

-- Wild pigs (n = 30) was found to be 302.99 ng/g

-- Desi pigs (n = 15) was found to be 110.52 ng/g

-- Cross bred pigs (n = 15) was found to be 18.59 ng/g

Meteorological parameters and conflict

The different meteorological parameters comprising of temperature (degree centigrade), relative humidity (per cent), wind speed (Kmph), soil temperature (degree centigrade), rainfall (mm) and solar radiations (cal/cm^2) have been presented in Table 7. The range of values for each of the meteorological parameters has also been furnished. As mentioned earlier, conflicts were recorded as low, moderate and high.

- Low-infrastructure damage, water source contamination, rooting of land and ecological damage
- Moderate-agricultural crop raiding, livestock preying, damage to forest restoration and grasslands
- High-injury to humans, causing fatalities

Interestingly there were no seasonal variations in occurrence of conflict except in areas adjoining Mudumalai which showed significant variations (Table 8).

Discussion

Faecal glucocorticoids

Glucocorticoids are "Stress hormones" and their basic function is regulation of energy. The emergency-response actions are mediated by circulating levels of glucocorticoid metabolites which in turn is based on stress levels and when an unexpected challenge is met, an allostatic overload occurs. This stress mediated challenge occurs due to many reasons but the main factors causing increase in glucocorticoids above the threshold level are food deprivation, predator threat and environmental factors. The utilities of cortisol assessment in wild pigs and desi pigs, in addition to the cross bred pigs, were assessed. This was in agreement with the report presented by Carlsson et al. [11] who opined that non-invasive sampling method, based on the quantification of stress sensitive molecules, were important in the objective assessment of animal welfare as an alternative to the quantification of such molecules in blood. This was supported by Touma and Palme [12] who opined that the non invasive monitoring of the steroid hormone metabolites in faeces of mammals had become an increasingly popular technique in the recent years, since it offered several advantages. In this regard, it becomes noteworthy to mention the reports presented by Borell and Schaffer [13] who revealed that non invasive measurements of stress indicating metabolites in saliva, faeces or urine had been

Faecal samples	Western ghats		Eastern ghats	Total
	Mudumalai	Anamalai	Sathyamangalam	
Wild pig	10	10	10	30
Desi pig	5	5	5	15
Cross bred pigs	5	5	5	15

Table 1: Fresh fecal samples were obtained from free-ranging wild pigs.

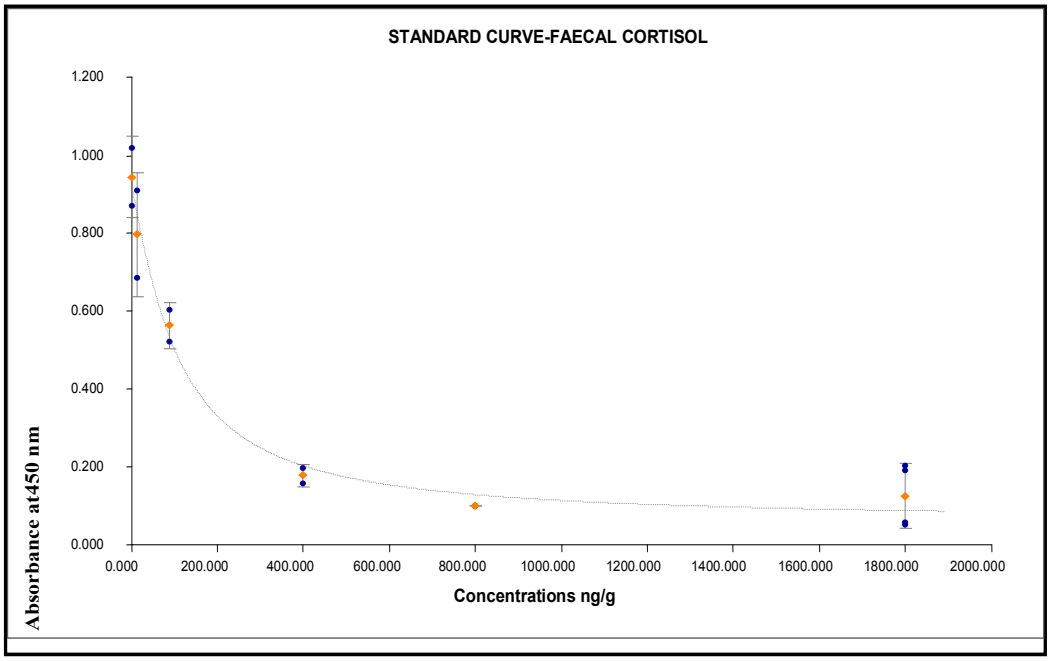

Figure 1: value of cortisol concentration of the unknowns was read directly from the calibration curve.

recently developed and validated and were useful parameters with regard to the legal requirements and assessment of stress and welfare in pigs. Enzyme Linked Immunosorbent Assay (ELISA) was used throughout this study with samples obtained from wild pigs, desi pigs and cross bred pigs. The usage of ELISA technique as carried out in the study was in agreement with the report furnished by Sink et al. [14] who opined that when compared with radio immunoassays, the usage of ELISA technique for the detection of cortisol level had merits in terms of elimination of health hazards and costs of handling radio isotopes.

Throughout this study, fresh faecal samples that were subjected to thorough mixing were obtained from all the pigs under study and cortisol assessment was carried out with only these faecal samples. In this regard, Schwarzenberger et al. [15] opined that the faecal samples had the advantage that they could be easily be collected without stressing the animals. Washburn and Millspaugh [16] opined that the environmental conditions might influence the faecal glucocorticoid metabolite measurements, if the samples could be collected immediately after the deposition and the faecal samples exposed to rainfall might not be suitable for faecal glucocorticoid analysis, because it might lead to artificial elevation of faecal glucocorticoid measurements. Obtaining of samples from well mixed faecal materials of the pigs under this study was in agreement with the findings reported by Millspaugh and Washburn [17] who opined that since using only a few pellets from a faecal mass might lead to a biased interpretation of the assay, homogenization of the faecal mass before removing a sub-sample of faecal material for analysis was effective. In this regard, it becomes noteworthy to mention the report of Palme and mostl [8] who opined that the faecal steroids might be unevenly distributed in the faecal balls of horses, swine and elephants. Hence, throughout the study, extra care was taken to obtain homogenized faecal samples from the wild pigs, desi pigs and cross bred pigs. Throughout the collection procedure, 80 per cent of methanol was used for the storage of fresh and well homogenized faecal materials of the wild pigs, desi pigs and cross bred pigs. This was supported by the finding reported by Palme and mostl [8] who revealed highest recoveries of faecal glucocorticoids during the storage of wet faeces in 80 per cent methanol. Similarly, the faecal samples in 80 per cent methanol were stored at -20°C prior to subjecting the faecal samples to ELISA technique and this was in agreement with the report presented by Khan et al. [18] who emphasized on the stability of faecal glucocorticoids when stored at -20°C in these preservatives.

The mean faecal cortisol level of the pigs in each of the adjoining areas of Mudumalai, Sathyamangalam and Anaimalai wildlife regions have been revealed in Tables 2-4 and in addition to this, the cortisol values of each sample from these pigs have also been listed. Comparatively, cortisol levels in faecal samples were observed to be lower in cross bred pigs than the desi as well as wild pigs. Similarly, the mean faecal cortisol levels were higher in wild pigs than the desi pigs, as well as the cross bred pigs. The variations in stress levels due to the existence of multifaceted etiological factors including the differences in the management-related measures might be assigned as the causal factors for encountering such differences in the levels of faecal cortisol concentrations pertaining to the wild pigs, desi pigs and cross bred pigs. The overall mean cortisol level was found to be 302.99 ng/g in case of wild pigs, whereas the overall mean cortisol level in desi pigs was 110.52 ng/g and it was 18.59 ng/g in cross bred pigs. During the statistical analysis (Table 5) in this study, the mean faecal cortisol concentration in wild pigs was found to be higher, followed by desi pigs then cross bred pigs. The mean cortisol level of wild pigs was found to reveal highly significant variations ($P \leq 0.01$), when compared to desi pigs, as well as cross bred pigs in the adjoining areas of Mudumalai, Sathyamangalam and Anaimalai wildlife regions. The existence of such highly significant variations in terms of increase of faecal cortisol level in wild pigs might be attributed to the various biotic as well as abiotic factors, like reduced availability of feed materials including water for drinking, adverse change in the environmental conditions, proximity of various species of predators and visitors, agonistic encounters, social challenges, lack of highly palatable and easily available feed resources

S.No	Adjoining Regions mudumalai (n=10)	Adjoining Regions sathyamangalam (n=10)	Adjoining Regions anaimalai (n=10)
1	175.79	141.81	245.63
2	575.66	256.83	201.91
3	579.39	413.42	464.56
4	322.25	254.75	245.68
5	227.94	146.18	235.87
6	225.95	277.92	241.01
7	684.37	154.85	306.56
8	178.74	265.77	515.43
9	276.47	148.12	397.33
10	247.52	175.98	506.30
MEAN	**349.41 ± 59.81**	**223.57 ± 27.53**	**336.03 ± 38.83**

Table 2: Faecal cortisol level in wild pigs (ng/g).

S.No	Adjoining Regions mudumalai (n=5)	Adjoining Regions sathyamangalam (n=5)	Adjoining Regions anaimalai (n=5)
1	116.40	132.43	112.23
2	109.25	103.22	95.65
3	103.73	152.31	97.42
4	90.13	177.48	75.29
5	76.31	154.96	61.04
Mean	**99.17 ± 7.16**	**144.08 ± 12.46**	**88.32 ± 9.00**

Table 3: Faecal cortisol level in desi pigs (ng/g).

S.No	Adjoining Regions mudumalai (n=5)	Adjoining Regions sathyamangalam (n=5)	Adjoining Regions anaimalai (n=5)
1	27.28	16.67	12.03
2	28.67	14.96	14.06
3	26.82	15.64	13.10
4	25.80	16.52	12.54
5	27.38	16.05	11.31
Mean	**27.19 ± 0.46**	**15.97 ± 0.31**	**12.61 ± 0.47**

Table 4: Faecal cortisol level in cross bred pigs (ng/g).

Adjoining regions	Pigs	Mean(ng/g)	F-value
Mudumalai	Wild pigs (n=10)	349.41 ± 59.81^{b}	11.120**
	Desi pigs (n=5)	99.17 ± 7.16^{a}	
	Cross bred pigs (n=5)	27.19 ± 0.46^{a}	
Sathyamangalam	Wild pigs (n=10)	223.56 ±27.52^{c}	17.17**
	Desi pigs (n=5)	144.08 ± 12.46^{b}	
	Cross bred pigs (n=5)	15.97 ± 0.31^{a}	
Anaimalai	Wild pigs (n=10)	336.03 ± 38.83^{b}	26.123**
	Desi pigs (n=5)	88.32 ± 9.00^{a}	
	Cross bred pigs (n=5)	12.61 ± 0.46^{a}	

Table 5: Comparison of mean faecal cortisol level among pigs of adjoining regions (ng/g).

Means bearing different superscripts in the group differ significantly
ns-not significant ** highly significant (P ≤ 0.01).

etc. [3]. The increased faecal cortisol level as encountered in wild pigs of this study when compared to desi pigs or cross bred pigs might be due to the stress factors operating on this species.

In this regard, it becomes noteworthy to mention the report furnished by Pride [19] who quoted that glucocorticoid measures could be useful predictors of individual survival probabilities in the wild populations and existence of high glucocorticoid levels indicated the lowered individual fitness or even population variability. Mateo [20] opined that elevation of cortisol observed at emergence might facilitate the acquisition of anti-predator behaviors. The elevated level of faecal cortisol concentrations in majority of individual wild pigs, compared to the maximum range of (177.48 ng/g) of faecal cortisol in desi pigs indicated the existence of stress-causing factors pertaining to the wild pigs belonging to Mudumalai, Sathyamangalam and Anaimalai wild life regions. Hence it could logically be assumed that the wild pigs get involved in human-animal conflicts by interfering with the agriculture fields developed by the farming communities inhabiting the immediate adjoining areas of these three wildlife regions. However, in order to arrive at a concrete conclusion, the undertaking of further research comprising of more number of wild pigs inhabiting especially the core areas of selected wildlife regions is warranted.

Similarly, the mean faecal cortisol level of desi pigs revealed (Table 5) highly significant variations (P ≤ 0.01) when compared with the mean faecal cortisol level of cross bred pigs in case of adjoining areas of Sathyamangalam regions only. The reasons for encountering highly significant rise in the mean faecal cortisol level in desi pigs might be attributed to the lack of availability of feed resources and drinking water, inconvenient housing arrangements made by the owners and lesser health-care related measures in the areas that were studied. The mean faecal cortisol level within pigs of different regions however failed to reveal any significant variations within the wild pigs of adjoining areas (Table 6) of Mudumalai, Sathyamangalam and Anaimalai. Lesser disturbances in terms of number of visitors, however, might be assigned as the reason for the occurrence of lesser mean faecal concentration level in wild pigs of the adjoining areas of Sathyamangalam region. Similarly, the different types of housing arrangements, variations in feeding regiment, variations in the husbandry and management related practices, variations in the health-care related measures, variations in the environmental conditions etc. might be assigned as the causal factors for the encountering highly significant variations (P ≤ 0.01) pertaining to the mean faecal cortisol concentrations in case of cross bred pigs.

Comparison of overall mean faecal cortisol concentration in wild pigs of the Western Ghats comprising of regions adjoining Mudumalai and Anaimalai with that of the Eastern Ghats comprising of regions adjoining Sathyamangalam revealed elevated mean faecal cortisol concentrations in case of faecal samples obtained from the Western Ghats. The increased number of visitors, varying types of habitat,

Animals	Adjoining regions	Mean (ng/g)	F-value
Wild pigs	Mudumalai (n=10)	349.41 ± 59.81	**2.453^{NS}**
	Sathyamangalam (n=10)	223.57 ± 27.53	
	Anaimalai (n=10)	336.03 ± 38.83	
Desi pigs	Mudumalai (n=10)	99.17 ± 7.16^{a}	**9.115****
	Sathyamangalam (n=5)	144.08 ± 12.46^{b}	
	Anaimalai (n=5)	88.32 ± 9.00^{a}	
Cross bred pigs	Mudumalai (n=5)	27.19 ± 0.46^{c}	**329. 82****
	Sathyamangalam (n=5)	15.97 ± 0.31^{b}	
	Anaimalai (n=5)	12.61 ± 0.47^{a}	

Table 6: Comparison Of Mean Faecal Cortisol Level In Pigs Among Adjoining Regions (ng/g)
Means bearing different superscripts in the group differ significantly
ns-not significant ** highly significant (P ≤ 0.01)

variations in climatic factors, increased tourist activities etc. might be assigned as the reason for occurrence of elevated mean cortisol concentration in samples from adjoining areas of the Western Ghats.

Environmental Changes and Conflicts

Although the extremes of temperature including solar radiations in both the summer and winter seasons, varying levels of humidity (Table 7) and other related factors could lead to stress in case of the wild pigs of the wildlife regions, it was also equally true that most of the stress-causing factors like existence of competition related to feed resources among co-existing species belonging to different taxonomic classes, presence of predators or hunting type of carnivorous species like tigers and leopards, etc. were found to be an almost persistent type of stress-related factors in case of the wild pigs. Further, variable crops were planted in both the summer and winter seasons by the related farming communities. Also the presence of more number of wild pigs may alter the food webs, which may also be altered due to the response to predators, human exposure, pollution and habitat change. Hence, logically it could be stated that conflicts between wild pigs and humans in terms of entry into the agriculture fields, in particular, might occur throughout the year, regardless of the occurrence of variations in the meteorological parameters documented in summer as well as in winter seasons (Table 8). The outcomes of these conflicts are tragic, leading to loss of life of a wild animal or a human [4]. Environmental changes surely affect the ecological balance and cause an extended damage on the wild animal populations. Wild pigs are habitat generalists and they have amazing adaptability and meeting out challenges proving fitness parameters such as survival and reproductive success.

It becomes important to mention the report furnished by Allwin et. al. [21] who opined that the endoparasites within wild pigs can serve as stressors and contribute to the allostatic load. Watve [22] encountered higher helminthic loads in animals during the dry season, when compared to the wet season in the wild life region. Similarly, the variations in wind speed as recorded in the Table 6 could be associated with the movement of wild pigs and this was in agreement with the findings furnished by Wobeser [23] who quoted that abnormal weather over a short or long time might allow population of animals to expand their home range and further, Busch and Hayward [24] revealed the linkage between the climatic change and feed abundance for the wild animals. Hence, all these were logically linked to the movement of wild animals including the wild pigs. Further Ananthasubramaniam [25] also linked the environment related factors like temperature, humidity, atmosphere and light including the predators and the competitors, with the movement of wild animals. The wild pigs now co-inhabit areas close to human dwellings and causes excessive damage to the crops. Food abundance, high palatability and low predator pressure allow the wild pigs to lead a superfluous life and this explains the population overcrowd. The carrying capacity will eventually be compromised and critical conditions may be depleted that would cause an entire shut down of the ecosystem. The water level in Pykara dam of Mudumalai, Aliyiar dam of Anaimalai and Bhavanisagar dam of Sathyamangalam, in addition to the natural as well as artificial water holes in these wildlife regions could overall be associated with the movement pattern of different wild animal species, including the wild pigs and water could be one of the significant factors pertaining to the conflict. This was in agreement with the report furnished by Desai et al. [26] who opined that areas close to water like the human-settlement areas were the preferred areas for wild animals.

The mean faecal cortisol concentrations in the case of wild pigs were found to be increased, when compared to these values in case of either the desi pigs or the cross bred pigs. Hence, a systematic research programme is highly warranted in the protected regions like Mudumalai tiger reserve, Sathyamangalam tiger reserve and Anaimalai tiger reserve with regard to the identification of stress-causing factors like tourists or visitors entry, availability of the routinely consumed feed varieties, availability of the highly palatable feed varieties, increase in predator density, increase in competition among the co-existing herbivores and omnivores in the concerned wildlife region, carrying capacity of the region, extensive activities or manipulation by human beings in the forest regions, persons entering the wildlife regions for the purpose of collection if plants, fallen wood, leaves etc.

Conclusion

Wild pigs have been thriving very well and their population increase led to various outcomes including human-wild pig conflict and wash out of the apex predator, thus collapsing an ecological pyramid. The occurrence of increased mean cortisol concentration in wild pigs that entered agricultural fields adjoining the wildlife regions indicated the existence of possible stress factors affecting the wild pigs. Additional guidelines are necessary with regard to prevention or minimizing of the human casualties, especially when people enter into forests for the collection of fuel wood, fodder, medicinal plants and grazing of the livestock, which ultimately reduces conflict. It becomes a need to increase the number and type of awareness programmes among the farming community in areas adjoining the Mudumalai, Sathyamangalam and Anaimalai wildlife regions. The meteorological parameters that were varying in different months, with regard to the range of temperature, relative humidity, wind speed, soil temperature, rainfall and solar radiation contributed to the conflict arousal in a haphazard manner. All these in addition to the variations in the planting, ripening or fruiting or the harvesting activities might get associated with occurrence of conflicts with wild pigs throughout the year. Further, it could be stated that the conflicts between wild pigs and humans encountered in the areas adjoining the wildlife regions might also be due to the adaptive behavior of the wild pigs in the wake of both destruction of its natural habitat and progressive decline of its natural wild food-base. The easy access to more energy rich food resources or highly palatable food resources might be associated as one more feature pertaining to the occurrence of conflicts between the wild pigs and humans, driving the wild pigs into human settlements. Wild

Places	Season	Temperature °C		Relative humidity %	Wind speed (kmph)	Soil temp °C	Rain Fall (mm)	Solar rad (cal/cm2)
		Max	Min					
Mudumalai	Winter	28.32	10.73	91.25	4.2	9.65	12.96	280.45
	Summer	30.32	18.74	83.25	4.3	20.03	6.08	388.84
Sathyamangalam	Winter	29.33	14.55	70.65	5.1	25.12	6.21	370.16
	Summer	35.87	22.34	69.38	6.9	32.22	0	510.05
Anamalai	Winter	28.66	15.45	91.25	4.2	9.65	12.96	280.45
	Summer	37.42	19.14	79.15	5.7	23.98	7.54	419.55

Table 7: Meteorological parameters of the various regions during the seasons.

S.no	Season	Low	Medium	High	X^2
Mudumalai	**Winter**	32 (**48.48%**)	27 (**40.90%**)	7 (**10.6%**)	**7.48***
	Summer	23 (**79.31%**)	5 (**17.24%**)	1 (**3.44%**)	
Sathyamangalam	**Winter**	16 (**45.71%**)	18 (**51.42%**)	1 (**2.86%**)	**2.67^{NS}**
	Summer	2 (**20.00%**)	8 (**80.00%**)	**Nil**	
Anamalai	**Winter**	4 (**16%**)	21 (**84%**)	**Nil**	**0.53^{NS}**
	Summer	4 (**33.33%**)	8 (**66.66%**)	**Nil**	

Ns-not significant

*-significant
**-highly significant

Table 8: Seasonal variation of conflict.

pigs are often neglected offenders in the list of conflict-causing animals, but their cumulative damage may lead to tragic outcomes. It is very essential to try and intervene in regulating the wild pig population, otherwise a catastrophe is in store and the damage will be irreversible.

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