CHAPTER-I
INTRODUCTION

Agonistic behaviour is an important constituent of the repertoire of a large variety of animals. The term "agonistic" includes both aggressive and submissive behaviours (Wilson, 1980; Jolly, 1985; Richard, 1985). Researchers in the field of comparative psychology, ethology, zoology, sociobiology and allied behavioural sciences have been debating and continue to debate on the complex phenomenon of aggression (Southwick, 1972; Archer, 1988) despite various controversies surrounding this concept. Reference to the concept of agonistic behaviour has also been made by Charles Darwin in The Expression of the Emotions in Man and Animals (Darwin, 1872) in terms of "hatred" and "anger". In addition to this, Darwin described some other forms of emotion which were considered a part of continuum of responses varying from "hatred" to "anger". Later on, Scott(1958) used the term agonistic behaviour and defined it as a constellation of a number of behaviour patterns that are associated with aggression and submission. Scott further described agonistic behaviour as a system which consists of many patterns of behaviour having common functions of adaptation to situations that involve physical conflict between members of the same species. In his descriptions, Scott also speculated that it was difficult to analyze fighting behaviour without studying the behaviour patterns of escape, threat, freezing, defensive posture, dominance and subordination, etc.

In another paper, Scott (1974) outlined that agonistic behaviours as a system of behaviour are adaptive in nature and primarily occur in conflicting situations. Such situations
Intragroup conflicts occurring between the individuals of a social group as well as intergroup conflicts occurring between the social groups of the same species. The term intragroup agonistic behaviour, according to Southwick (1967), involves all aspects of overt aggressive and submissive interactions of individuals in conflict situations within the group.

More recently, Knox and Sade (1991) described the term agonistic behaviour in terms of two different components: dominant component and submissive component. According to Knox and Sade, the dominant component involves both attack and threat responses which are generally directed toward a subordinate individual, whereas a subordinate component operates in a process in which the subordinate animal performs gestures of subordination in response to the aggressive behavior of the attacker.

In an important paper, Tinbergen (1968) has proposed that both attack and avoidance behaviors constituted an intact system essential for the survival of the species. Aggression, according to Tinbergen, is one part of the behaviour continuum, the other being avoidance. Describing this attack-avoidance phenomenon, Tinbergen wrote: "when neighboring territory owners met near their common boundary, both attack and withdrawal behaviours were elicited in both the contestants, and during such agnostic interaction, each one of them remained in a state of motivational conflict." Tinbergen further emphasized that avoidance behaviour is not only important in reducing injury to oneself, but it also controls the hostile clashes.

The term "agonistic behaviour" is now accepted by several contemporary zoologists, ethologists, sociobiologists,
sociologists, anthropologists and psychologists as a complex behaviour pattern consisting of a full range of aggressive and submissive behaviours associated with conflict (Southwick, 1972; Wilson, 1980; Archer, 1988). Southwick (1972) has noted that behaviours other than those of an offensive nature are also closely related to aggression, both in actual occurrences and in biological and neurological organization. These are the defensive behaviours of "immobility", "submission", and "escape". He noted that the tendency to attack is often associated with the tendency to threaten as well as with the tendency to submit, and/or escape. According to Barash (1982), agonistic behaviour in animal species consists of a wide variety of encounter patterns that include exact forms of aggression and the responses to aggression (e.g. threatening back, fighting, running away or some forms of submissive signals).

The manifestations of the agonistic behaviour in some nonhuman primates occur in the form of emotional expressions of varied intensity, and such expressions involve a series of responses along an anger-fear continuum (Chevalier-Skolnikoff, 1973).

1.1 CONCEPT OF AGGRESSIVE BEHAVIOUR

The phenomenon of aggression can be found throughout the animal kingdom from some of the most ancient phyle whose members possess very simple nervous systems to those with complex neural mechanism (Archer, 1988). In human beings as well as in other nonhuman primates, aggression is expressed in a wide variety of ways. The expression of aggression may vary from subtle postures and communicative signals of threat to violent forms of the
fighting response. Because the term 'aggression' is used in different ways due to its widely varied forms of expression in several animal species, it is difficult to define aggression accurately and completely.

Webster's Collegiate Dictionary (1970) defines the term aggression as "an offensive action or procedure, the practice of making attack or encroachments...overt forceful action". The term aggression and its meaning is both controversial and elusive (Fedigan, 1982). The ethologists and psychologists have assigned divergent meanings to the concept of aggression.

In a book On Aggression (Lorenz, 1966), the pioneer of ethology, Konrad Lorenz described aggression as an instinct or unlearned response which helps to ensure the survival of the individual and the species as a whole in their ecological setting. Lorenz asserted that killing animals of other species is not an act of aggression. Rather when animals belonging to a particular species turn on each other and fight they are said to be behaving aggressively toward each other. He defined aggression as an appetitive motivation.

According to some psychologists, aggression is a way of coping with threat or frustration as well as with an emotional state (Dollard, Doob, Miller, Mower & Sears, 1939; Berkowitz, 1962). A number of ethologists (Morris, 1967; Eibl-Eibesfeldt, 1970), sociologists and anthropologists (Tiger & Fox, 1971), and psychiatrists (Storr, 1968) have also defined aggression as an innate or instinctive tendency. Some other ethologists have agreed on definition of aggressive behaviour. According to such a definition aggressive behaviour is primarily directed towards
inflicting physical injury on another individual (e.g. Southwick, 1972; Carthy & Ebling, 1964; Hinde, 1974).

In some behavioural studies, the meaning of the term aggression is defined on the basis of the psychoanalytic concepts of Freud and Adler who define aggression as a drive to express hostile or destructive tendency (Archer, 1988). Freud's concept of aggression was strongly opposed by Lorenz (1966) who rather contended that from the evolutionary point of view aggression is unlikely to be a mechanism of self-destruction in animals. Lorenz also argued that aggressive behaviour is normally useful and functional to the survival of a species. However, the causation of aggression is complex and heterogeneous. From the functional viewpoint, those behaviours can be considered aggressive which are used to steer the behaviour of another individual by force. Morphologically, a class of behaviours can be distinguished that are brusque (tense forms of physical treatment). Whereas morphological and functional aspects make relatively easy differentiation of aggression possible, the causal aspects are difficult to establish (Angst, 1980 in Adang, 1984).

Aggression in the animal kingdom is described by sociobiologists and ethologists as a means of competition over some types of beneficial resources (Wilson, 1975; Clutton-Brock & Harvey, 1976; Geist, 1978; Archer, 1988). Competitive aggression is distributed in a wide variety of its forms throughout the animal kingdom (Wilson, 1975; Huntingford & Turner, 1987). Competition is often described by ethologists as the active demand by two or more individuals for a resource or requirement that is potentially limiting (Bakker, 1961; Wilson, 1975). Aggression, according to Barash (1982), is a fundamental characteristic of
nearly all living organisms, and operates as a proximate mechanism in the context of contest competition involving an aggressive interaction between individuals in such a manner that one of them is forced to surrender. Two different forms of competition for resources can be distinguished in several animal species. These are as follows: contest and scramble competition (Barash, 1982). Contest competition occurs when two or more competitors interact aggressively in order to obtain the resources which are sufficient to maintain their survival status. In scramble competition, on the other hand, the individuals are involved in obtaining as much of the scarce resource as possible without directing any form of aggression towards each other.

Several sociobiologists are of the view that aggression is an overt expression of anger response and is frequently shown in some contest competition (Wilson, 1980). In several species of animals including nonhuman primates, aggression is generally expressed in a wide variety of ritualized patterns of postures, movements, facial expressions and sounds. Such ritualistic pattern of behaviours serve as adaptive mechanisms in the process of communication among the animals (Southwick, 1972; Chevalier-Skolnikoff, 1973).

Kawamura (1967) noted long back that aggression involves two basic patterns of "threatening behaviour", such as Type-A and Type-B. Type-A pattern is primarily directed to intimidate or frighten the opponent, whereas in Type-B pattern the opponent is attacked or driven away. Kawamura further noted that as compared to Type-B aggression, Type-A aggression is effective for the animal because it is often accompanied by other actions, such as
pretending to scratch, scratching the soil, or pacing back and forth.

Van Hooff (1971) made a cluster analysis of the aggressive behaviour of chimpanzee and found that the expression of aggression occurred in the form of a sequence of behaviours (e.g., "tug", "brusque-rush", "bite", "grunt-bark", "shrill-bark", "arm-sway", "stamp", "hit", "stamp-trot", "trample" and "sway-walk"). Van Hooff further made subclustering from the broader cluster of aggression and noted that the "tug", "brusque-rush", "bite", "grunt-bark" and "shrill bark" represented attack behaviour.

From the above analysis it is clear that some investigators working on aggressive behaviour are trying to understand its immediate or proximate causation, whereas others are trying to understand the ultimate cause or survival value of aggression.

The phenomenon of aggression can comprise of a combination of different sets of phenomenon. Several authors have suggested different tentative processes to classify different kinds of aggression. These tentative processes provide systematic ways to organize the complex sets of phenomena involved in aggressive behaviour.

Lorenz (1966) distinguished six types of innate aggression, such as (i) predatory aggression (e.g. attack of the predator on the prey); (ii) mobbing (e.g. the prey making counter attacks in force against a predator); (iii) critical reaction (e.g. the desperate fight of an animal that cannot escape from the source of danger); (iv) territorial aggression (e.g. an animal showing active fight response towards source of danger on familiar ground); (v) rival fights (e.g. an animal, generally male,
lighting for sexual partners); (vi) brood defense (e.g. an animal defending the young animals from the source of dangers). Furthermore, Lorenz stated that the predatory aggression, mobbing and critical reaction usually occur between members of different species, whereas territorial aggression, rival fight and brood defense tend to take place between members of the same species.

Feshbach (1964) outlined two different kinds of aggression (i.e. instrumental aggression and hostile aggression). Later on, Moyer (1968) extended the typologies of Lorenz and Feshbach and suggested that animals show eight types of aggression: (i) predatory aggression; (ii) fear-induced aggression; (iii) irritable aggression; (iv) instrumental aggression; (v) inter male aggression; (vi) maternal aggression; (vii) territorial aggression; and (viii) sex-related aggression (Archer, 1988).

From the above description about the varied nature of the term aggression, certain questions arise as to "what is the value of aggression?" and "what purpose does it serve?". In most mammalian species the aggressive drive helps the animals compete with other animals of the same and/or different species over limited food resources; it develops in the animals the tendency to fight under an extreme threatening situation; and it increases the sexual motivation of the animal for a successful selection of a sexual partner.

In nonhuman primates aggression plays an important role and has varied functional values or selective advantages for the individual as well as for the species (Southwick, 1972; Bernstein & Gordon, 1974). Southwick (1972) has suggested five selective advantages of primate aggression. These are as follows: (i) to serve as a defense against predators; (ii) to maintain spacing of
social groups and regulate population density; (iii) to make use of the habitat effectively and extend the home range; (iv) to facilitate better chances of survival in competitive communities; and (v) to make effective sexual as well as leadership selection. Bernstein and Gordon (1974), however, suggested that in primate societies aggression serves two important functions: (i) as a regulating force, in establishing and maintaining a balance in the structure of social interactions; and (ii) as a biological mechanism it may function to protect the group from some predators. They further noted that uncontrolled aggression is as harmful to primate societies as is the complete absence of aggression.

Although the concept of aggression and its functional values in the primate societies still remain elusive as well as controversial ( Bernstein, 1981; Fedigan, 1982), the emergence of sociobiology has added a new dimension to the understanding of primate aggression by focusing on causal mechanisms (Wilson, 1980; Krebs, 1985; Stamps, 1991). Aggression may serve multiple functions, but what really links to the vital functional issue of aggression is the antecedental causes that provoke aggression. The antecedental factors which lead to aggression can be described on the basis of the proximate (or immediate) and the ultimate mechanisms.

The proximate factors refer to those internal and/or external stimuli which can trigger of aggressive behaviour by some forms of mechanisms (e.g. biological and social) involved in them.

A particular kind of behaviour may not constantly be occurring and we may ask "when does it occur?" This is, of
course, a variation of the "why question" and is answered in terms of proximal cause (Tinbergen, 1951). By asking "why does a particular behaviour occur?", we focus our attention on the immediate context in which that behaviour occurs. Moreover, in order to determine why the animal performed a particular response we look at the stimuli in the environment just prior to the occurrence of that behaviour. According to Bernstein (1988), the proximal cause of the occurrence of a particular behaviour focuses our attention to look for the stimuli that preceded the behaviour. The ultimate factors of aggressive behaviour have their origin in the process of evolution (Barash, 1982; Fedigan, 1982; Box, 1991). Scott (1974) has emphasized that the most important cause of the agonistic behaviour is associated with immediate or proximate factors. For example, an animal would react to attack or drive another animal if the second animal creates noxious stimulation for the first one. Similarly, Fedigan (1982) noted that simple proximity of another animal would not lead to aggression, rather proximity provokes aggression only in certain contexts in which the proximal animal is perceived as a noxious stimulation.

Both aggression and submission may take many forms of response patterns. Understanding and interpreting the significance of expressions of defense, submission and aggression are not enough for overall evaluations of the nature of resulting patterns. But the situations in which they occur must be considered (Bernstein, 1967). In the same paper, Bernstein has noted that "aggression has often been related to competition, and since the definition of competition can be all-encompassing or circular, extremely high correlations can be
produced; thus, situations which often lead to interpretations of competition and aggression are traced to competition for food or mates." Bernstein further noted that although aggression in monkeys can in fact be produced by stimulating competition in laboratory situations, such competition is relatively rare among free-ranging nonhuman primates. In free-ranging situations aggression can be triggered by 'violation of the social code' (e.g. the aggressive punishment inflicted by the male on a female for wandering too far from him); by 'injury or perceived potential injury' (e.g. in an attacking situation a monkey may fight especially if the attacker is not a group member or even a nonspecific); by contact with an animal of another troop or an intruder, by the presence of a predator, or by general disturbance within a group. In most of these situations submissive responses may occur.

1.2 CONCEPT OF SUBMISSIVE BEHAVIOUR

Agonistic behaviour not only includes behaviours of offensive nature, but also comprises of many other behavioural patterns which are defensive or submissive in nature. In several animal species submissive behaviours are commonly expressed in the forms of immobility, submission or escape (Southwick, 1972). In some other animals subordination is expressed in the form of stereotypical submissive gestures. Among the nonhuman primates, the expression of stereotypical pattern of submissive gestures is the characteristic behavioural feature in macaques (Bernstein, Schusterman, & Sharpe, 1963; Southwick, 1972; Fedigan, 1982; Jolly, 1985; Richard, 1985).
Lorenz (1966) has pointed out that in several highly aggressive animals, some checks and balances operate upon them and help reduce the intensity of aggressive manifestations. Furthermore, Lorenz has noted that on rare occasions the intraspecific aggression in animals resulted in disastrous or fatal outcomes. There may be furious fighting, but serious wounds and deaths are rare. Lorenz also suggested that many species have evolved inhibitory mechanisms to reduce or stop intraspecies aggression before it becomes really dangerous or fatal. Such inhibitory mechanisms consist of appeasement gestures or gestures of submission.

When two or more animals come together during occasions of social interaction approach-withdrawal responses are more likely to occur, although there is increased possibility of aggression (Tinbergen, 1952). Animals usually fight in order to gain access to important resources like food, mates, roosting sites. It is true that animals can and do engage in violent forms of fight causing serious injury to each other (Geist, 1978), but it is a rare phenomenon. Rather, animals have tendency to avoid or to show submissive gestures in a wide range of conflicting situations during their life.

The expression of submissive behaviour often involves the elimination of escape behaviour as well as aggressive postures. By showing gestures of submission, defeated animals may flee away without pursuit thus reducing the violence of conflict (Barash, 1982). As an alternative method, the adoption of withdrawal or immobility may reduce the aggression (Moynihan, 1955).

When animals begin emitting aggressive responses in an encounter response of the defeated animals may terminate the
encounter. In this context if the defeated animal flees, this may effectively terminate such agonistic interaction or reduce its intensity, and thus restore peace among the participant animals. There may be another situation in which the further aggression can be reduced by substitute behavioural responses which Bernstein (1981) calls "submissive responses".

Over the years ethologists have been raising some important questions with regard to the phenomenon of aggression and submission in animal societies: why do not animals always engage in all-out fight?, why do animals show one or another form of submissive gestures or self-restraints? (Barash, 1981). An explanation given by ethologists to these questions is that the species as a whole gain when fight takes a conventional or a ritualistic rather than a dangerous form. Now it is called a group selectionist argument. Modern ethologists and sociobiologists, however, explain the benefits of ritualistic or conventional fights in terms of individual and kin selection (Maynard-Smith, 1964). Furthermore, ethologists use a term "inhibition of aggression" to explain how animals cease fighting and adopt defensive strategies. In animal societies, the occurrence of gestures of submission during fight interaction serves as social releasers of the inhibition of aggression in their attackers. For example, a defeated wolf would expose the most vulnerable part of its body to the attacker seconds after their fighting turns violent. Such an exposure of the body on the part of the defeated animal results in the reduction of hostility of the attacker (Marler & Hamilton-III, 1966).

According to Lorenz (1966), some higher-order mammals who have dangerous natural weapons (e.g. the teeth of the wolf)
develop strong inhibitions of aggression and can survive intraspecies fights successfully. Animals with natural weapons but without such inhibitions would kill each other in intraspecies fight.

There are several explanations which emphasize the adaptive significance of subordination. One such adaptive behaviour in animals is dominance hierarchy which probably helps in keeping peacefulness in a group. Marler and Hamilton III (1966), however, views subordination as an adaptive strategy which helps subordinate animals to become more fit within their own social group. Another explanation with similar viewpoint is the kin-selection strategy (West-Eberhard, 1975). According to West-Eberhard (1975), dominant members in a social group maintain a high reproductive success if some of its individuals adopt subordinate strategy. Long back, Moynihan (1955) pointed out that during aggressive encounters some animals frequently adopt gestures of submission which have a direct function of reducing the opponent's aggression or of diverting the opponent to some other activity other than aggression. The fact that human beings and other animals express aggressive and submissive behaviours since they are essential for the effective survival of the individual, its kin and/or its group is fairly substantiated by observations and theories (Lorenz, 1966; Barash, 1982; Dunbar, 1988)

1.3 PROXIMATE AND ULTIMATE CAUSES OF AGONISTIC BEHAVIOUR

From the above review of literature on the concept of agonistic behaviour, it is clear that most of the investigators in the field of ethology, sociobiology, zoology and psychology agree that in several animal species, expressions of the
aggressive as well as the submissive gestures during agonistic interactions are advantageous in the process of establishing cohesive relations among individuals within the group.

In order to explain the adaptive and functional significance of aggressive as well as submissive behaviour, contrasting views have been given by several animal behaviourists (Barash, 1982; Stamps, 1991). This controversy seems to be based on giving emphasis to proximate or ultimate factors of agonistic behavior.

Lorenz (1966) has made a point that the expression of aggression in animal species is innately determined and primarily occurs spontaneously. There was a strong criticism of this idea of Lorenz, and fighting behaviour was considered to be determined situationally (Hinde, 1967). Analyzing these two opposite views of Lorenz and Hinde, Tinbergen (1968) came to the conclusion that aggression in animals is the result of influences of internal as well as external determinants. A similar explanation has been given by Barash (1982) who clearly states that aggression in animals may be strongly influenced by both genotype and environmental events. Tinbergen (1968), however, emphasized that the phenomenon of aggression in animal species as well as in man could be understood scientifically through a biological approach. Furthermore, Tinbergen suggested that studies on aggression should focus upon four questions: "(i) How does the phenomenon of aggression help the animal to survive?, (ii) Under what circumstances does aggression erupt at any given moment and what mechanism is involved?, (iii) How does the aggressive behaviour develop as the animal grows up?, and (iv) How have the animal species acquired the aggressive behaviour during the course of their evolution?"
A number of theories have been developed during the last many years to provide reasonable explanations to the varied nature of animal behaviour. Several such explanations, although analyzed in the perspective of evolutionary process, have focused on questions about proximal behavioural processes (Stamps, 1991).

The emergence of sociobiology provided animal behaviourists with a new approach to understanding the ultimate cause of aggressive and submissive behaviours in animal species (Wilson, 1980; Barash, 1982; Stamps, 1991).

Social scientists have often neglected evolutionary concepts of agonistic behaviour and stressed heavily on proximal causes. According to Bernstein (1984), evolutionary explanations do not provide answers to the question as to why agonistic behaviour occurs in social groups of primates. He contended that agonistic behaviour must be understood in complete contexts by analyzing several factors like season, weather condition, time-of-day and within group social organization. He further noted that such factors would function as proximal causes. He, however, did not rule out the possible interacting influence of heredity and past experience on the development of aggression or subordination or both in animals.

Studies of proximate causation focus on the immediate processes and mechanism (Hinde, 1975; Fedigan, 1982; Stamps, 1991) that generate or trigger a behaviour. The important questions relating to the proximate analysis of behaviour are as follows: "How does a behaviour develop within an individual?, In what situation can experimental manipulations change behaviour?, What stimuli evoke which behaviours?, What are the genetical, physiological and anatomical factors that have influence on
behaviour?, and How do they operate?" (Barash, 1982). Both short-term (e.g. snow, rain, wind, etc.) and long-term environmental (e.g. diurnal and seasonal changes) effects also operate as proximate factors of animal behaviour (Barash, 1982; Lee, 1991).

Questions which follow are related to proximate factors and have not been explored so far by primatologists. These questions with particular reference to nonhuman primates include, (i) Does the agonistic behaviour change in different seasons? (ii) Does it change diurnally? and (iii) How do two sympatrically living nonhuman primate species differ in their agonistic behaviour with seasonal as well as diurnal changes?

Studies of ultimate causation, on the other hand, emphasize the functional and adaptive significance of behaviour (Hinde, 1975). Like proximate causation, ultimate analysis of behaviour deals with certain important questions: what is the evolutionary origin of a behaviour in a population?, What is the adaptive significance of the behaviour?, How does the behaviour in animals increase their fitness?, Why do animals of similar or different species perform similar or different patterns of behaviour? (Barash, 1982). Behavioural ecology and sociobiology emphasize the evolutionary causes and functional consequences of behaviour (Wilson, 1980; Krebs, 1985). Indeed their approach highlights a different aspect of the same phenomena. Both approaches, the proximate and the ultimate, are interdependent and complementary (Wilson, 1980; Barash, 1982; Stamps, 1991). For example, Barash (1982) has aptly pointed out that proximate mechanisms of animal behaviour serve as "servants" or "tools" of ultimate causes.
Like other animals including nonhuman primates, human beings express aggression under several circumstances. According to Barash (1982), human beings express aggression (i) when the important resources are limited and can be obtained by contest rather than scramble competition, (ii) when painful or discomfort or frustrating situations arise, (iii) when social systems are disrupted and/or threatened, and (iv) when strangers appear. In addition to these factors, aggression in human beings can also be evoked in some other contexts involving individual-to-individual and individual-to-environment conditions.

The question as to whether human aggression is an innate phenomenon or a situation specific still remains controversial (Berkowitz, 1965). Although a sociopsychological approach to aggressive behaviour does not necessarily deny the human being's innate capacity for aggression, it has a somewhat different orientation. It deals with the ways in which aggression results from the interaction between the individual and the social environment. It also studies when, why and how an individual or group behaves aggressively toward another individual or a group (Sherif, 1970).

Lorenz (1966) stated that human aggression is innately determined. Criticizing Lorenz's view on the innate basis of human aggression, Montagu (1968), made a point that humans have no instincts, and aggression in man operates as an acquired or a learned phenomenon because he interacts with his culture, environment and other human beings. The ethologists now clearly acknowledge that the expression of aggression in animals based on innate factors can be changed in different contexts in which it occurs. Some other investigators stress the importance of
environmental determinants of aggression in man. Dollard, Doob, Miller, Mower, and Sears (1939) in their frustration and aggression theory, noted that aggression is caused by frustration which acts as an interference with the goal response. Later, in their social learning theory, Bandura and Walter (1963) emphasized that humans acquire aggression through observational learning/imitation of social models.

Several authors have contended that many aggressive actions are controlled by the stimulus properties of the available targets rather than by anticipations of end results (Berkowitz, 1962, 1965). Berkowitz (1962) has suggested that appropriate cues must be present in a situation if aggressive responses are actually to occur. In the field of researches on human aggression there is still considerable uncertainty as to what characteristics of stimulus evoke aggression. Although the association of a stimulus with aggression can enhance the aggressive cue value of that stimulus according to the principles of conditioning, the cue of the stimulus which may be either in the external environment or represented internally elicits the aggressive response later on alone, even in the absence of the original aggressive situation. As in the human beings, aggression in nonhuman primates extensively varies across different species as well as within the same species (Dunbar, 1988; Box, 1991).

In the early 1950s, Harlow (1951) speculated that comparative study of primate behaviour will be one of the thrust areas of research in the domain of comparative psychology. Being close to man in physique, temperament and behaviour, the nonhuman primates provide valuable information into the origins and nature of human relations. This has been proved to be
specifically true in case of field studies on the evolution of social behaviour (Wilson, 1980; Jolly, 1985).

Nissen (1951) wrote that the essence of social organization lies in the interaction process which may be positive (cohesive) and negative (conflicting or disruptive). Social organization, according to Nissen, is an integration of positive and negative factors patterned in succession. It may result in loosely organized to closely knit organizations. Primate researches over the last forty years, since 1950, have clearly indicated that variations in the nonhuman primates can be observed in this order.

Out of about two hundred species of primates distributed throughout the world, twenty are found in India. This rich primate resource includes 3 species of tree shrews, 2 of loris, 7 of macaques, 7 of langurs and 1 of ape. Although these primate species provide a variety of models of social organization, they have been rarely explored. The two species, the rhesus macaque (Macaca Mulatta) and the Hanuman langur (Presbytis entellus) are widely distributed in India and live in habitats similar to that of man (Roonwal & Mohnot, 1977). These two species provide ideal models for the comparative study of social behaviour, specifically agonistic behaviour.

Rhesus monkeys and Hanuman langurs have attracted several Japanese, American, European as well as Indian primatologists who have been conducting field studies on the ecology and behaviour of these two species in different parts of India for the last several years (Roonwal & Mohnot, 1977; Seth, 1983; Roonwal, Mohnot, & Rathore, 1984). One of the important outcomes of primate field studies is that the behavioural variability
exists in primate societies and that the cause of behavioural variability may be attributed to a number of biological as well as environmental determinants (Southwick, 1972; Fedigan, 1982; Dunbar, 1988; Box, 1991). Also, it is clear that variability in primate behaviour may occur between species and/or within a species (Southwick & Siddiqi, 1974; Teas, 1978).

Variability in the behaviour of the human population has aroused controversy among cross-cultural psychologists, ecologists and sociobiologists as well (Sahoo, Mishra, & Pirta, 1988). Although the primary focus in studies of nonhuman primates is to discover the phylogenetic history of man, an interesting outcome of primate field studies is habitat-specific variability in behaviour. This came as a surprise to the adherents of Crook-Gartlan Schema (i.e. arranging primates according to similarity in behaviour patterns (Crook & Gartlan, 1966).

Comparative studies on the agonistic behaviour of different nonhuman primate species especially in the field situations are very few and suffer from drawbacks in the design of the study. Firstly, sufficient quantitative data to prepare a base line of species' comparison are lacking. Although there are a few field studies revealing evidence of interspecific variations in the agonistic behaviour of several nonhuman primates (Fedigan, 1982), most of them are not based on sufficient data due to their short term study objectives. Secondly, in many field studies the data have been confounded by habitat, season and other proximate factors. Thirdly, comparison of the taxonomically different species of nonhuman primates do not provide adequate explanations of the behavioural variability among the species.
In India there is paucity of comparative studies on the behaviour of the nonhuman primates (Roonwal, 1977). Very few studies have been conducted to examine intraspecies variability, whereas interspecies variability has been rarely studied.

With regard to the agonistic behaviour of rhesus monkeys and Hanuman langurs, there are in fact very few studies conducted in India. Although evidence of variability in the agonistic behaviour in rhesus monkeys and Hanuman langurs have been reported in some field as well as laboratory studies in India (Southwick, 1972; Curtin & Dolhinow, 1978), no study has been made to compare the two sympatric species of nonhuman primates.

Agonistic behaviour in primates may be influenced by attributes of the individual, population and environment. As far as attributes of the individual are concerned, they are restricted within the individual by virtue of its membership in a particular species. These attributes can be better understood by the study of phylogenetic history of the species. Of course, our understanding of how such attributes determine the development of agonistic behaviour in nonhuman primate species is very poor. Nevertheless some studies on rhesus monkeys have given some explanations about the possible reasons why the animals show the agonistic behaviour (e.g. Southwick, 1967; Bernstein & Ehardt, 1985a; Thierry, 1986).

Several primate studies have revealed that variability in the expression of the agonistic behaviour occurs in different species of primates living under different environmental conditions. In such studies the investigators do not give clear explanations as to whether the variability in agonistic behaviour is a species-specific phenomenon or a situation-specific
phenomenon (Bernstein, 1981; Thierry, 1986). It is, therefore, realized that the question of "species-specific" and "situation-specific" issues of the agonistic behaviour (Figure 1.1) can be better understood by studying two or more primate species under same environmental settings. The rhesus monkeys and Hanuman langurs are two such primate species which live sympatrically over a large area in the Himalayas. With growing urbanization in various regions of the Himalayas, these two primate species are also becoming urbanized at certain places. Thus, they provide ideal conditions for making a comparative study of their behaviour.

In the present field study, the agonistic behaviour of rhesus monkeys (Macaca mulatta) and Hanuman langurs (Presbytis entellus) living sympatrically in the urban area of Shimla has been studied keeping in view the following objectives:

1. To compare the agonistic behaviour in rhesus monkeys and Hanuman langurs,
2. To study the seasonal differences in the agonistic behaviour of macaques and langurs,
3. To study the diurnal differences in the agonistic behaviour of macaques and langurs,
4. To study the species differences in the expression of micro-units of agonistic behaviour,
5. To study the age-sex class differences in the expression of micro-units of agonistic behaviour in macaques and langurs,
6. To compare the macaques and langurs for general eco-behavioural data.
Figure 1.1 An adult female rhesus monkey (Macaca mulatta) showing a gesture of aggression (threat)