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THE BATS OF WESTERN INDIA REVISITED[1]
Part 1

P.J.J. BATES[2], D.L. HARRISON[2] AND M. MUNI[3]

(With a plate and four text-figures)

Key words: Mammalia Chiroptera, India, Gujarat, Maharashtra, Karnataka, distribution, ecology, systematics, status and conservation

The systematics, distribution, ecology and biology of seventeen species of Indian bats are reviewed in the light of field work conducted in Western India during March, 1992. Significant changes of status are noted in some species in comparison with previous surveys. Conservation priorities are highlighted.

INTRODUCTION

Thirty years ago Brosset published a series of papers on the ecology and distribution of the bats in central and western India. In these four studies, Brosset (1962a, 1962b, 1962c & 1963) gave detailed accounts of the habits and habitats of 35 species of bat at 43 localities. In doing so, he provided an invaluable bench mark against which future naturalists could compare not only changes in species diversity at a particular site but also changes in population size.

The present authors revisited ten of the localities frequented by Brosset in an attempt to assess the fitness of the present bat populations vis-a-vis those observed thirty years previously. The localities were Bhuj, Rajkot and Ahmedabad in Gujarat; Mandu in Madhya Pradesh; Aurangabad, Ajanta; Ellora; Elephanta and Mahabaleshwar in Maharashtra; Belgaum and Talewadi in north-western Karnataka. All the localities were visited between 3 March and 28 March, 1992. This survey is part of a wider, longterm study to review the status, systematics, dis-

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tribution and ecology of all the Indian mammal species. A series of surveys to a range of contrasting biotopes within the Indian peninsula is being planned whilst a complementary study of the blood proteins is also being conducted by the junior author.

Methods

Specimens of the cave dwelling species were generally collected during the day using hand held butterfly nets, with aluminium handles. Additionally, some cave entrances were netted during the evening using ten and thirty foot Japanese mist nets. This allowed for the collection of species whose diurnal roosts were located in inaccessible crevices. On three occasions mist nets were set up in the open in an attempt to collect free flying bats not traceable to any particular roost; the localities included a pool in an otherwise dry river bed at Ajanta; the edge of a medium-sized lake at Mandu and a cliff edge at Mandu. Although many bats were seen at each of these localities, the yields in the nets were low with one, nil and four specimens being caught respectively.

Definitions of Measurements

HB: head and body length — from the tip of the snout to the base of the tail; T: tail length — from the root of the tail to the tip; HF: hind foot — from the extremity of the heel to the tip of the longest digit, not including the claw; FA: forearm — from the extremity of the elbow to the extremity of the carpus with the wings folded; E: ear — from the lower border of the external auditory meatus to the tip of the pinna; GTL: greatest length of skull — the greatest antero-posterior diameter of the skull, taken from the most projecting point at each extremity; CBL: condylobasal length- from an exoccipital condyle to the anterior extremity of the premaxillae; ZB: zygomatic breadth — greatest width of the skull across the zygomatic arches; BB: breadth of braincase-the width of the braincase at the posterior roots of the zygomatic arches; IC: interorbital constriction — the narrowest width across the interorbital region; PC: postorbital constriction — the narrowest width across the postorbital region; C-M^n: maxillary toothrow — from the front of the upper canine to the back of the crown of the last upper molar; C-M_n: mandibular toothrow — from the front of the lower canine to the back of the crown of the last lower molar; M: mandible length — from the condyle of the mandible to its most anterior projecting point, including the lower incisors.

List of Species Encountered

MEGACHIROPTERA

Rousettus leschenaultii
Pteropus giganteus
Cynopterus sphinx

MICROCHIROPTERA

Rhinopoma hardwickii
Taphozous longimanus
Taphozous melanopogon
Taphozous perforatus
Taphozous kachhensis
Megaderma lyra
Rhinolophus rouxii
Rhinolophus lepidus
Hipposideros fulvus
Hipposideros speoris
Hipposideros lankadiva
Otomops wroughtoni
Pipistrellus ceylonicus
Miniopterus schreibersii

Suborder MEGACHIROPTERA
Family PTEROPIDAE

Rousettus leschenaultii (Desmarest 1820) — Fulvous fruit bat

Pteropus leschenaultii Desmarest, 1820: Encyclopedique Method. Mamm., 1: 110. Pondicherry, India.

External characters: This is a medium-sized fruit bat with a short tail which protrudes from the interfemoral membrane. Males average larger than females with a mean forearm length of 83.2 mm (78-90 mm) as compared to females, 80.0 mm (74-84 mm). The ears are naked, conical in shape, partially opaque and a mid-brown colour throughout; there is no pale margin as in *Cynopterus*. The snout is well haired and robust, with the nostrils protuberant and separated from each other by a deep groove. The eyes, like those of all the Megachiroptera are relatively large; they appear dark brown by day and brilliant red in torch light. The pelage is a dull grey-brown throughout, tending to be paler on the shoulders in both sexes; occasionally greyer or more yellowish specimens are seen. Males have the glandular hairs on the throat more developed than the females, but not distinctively coloured. The wing membranes arise from the flanks and consequently the dorsal pelage is not narrowed. Both the first and second digits of each wing are clawed.

Cranial and dental characters: The skull is robust, with the rostrum noticeably more elongated than that of *Cynopterus sphinx* and with the braincase larger. The dentition is relatively delicate with the cheekteeth narrow in relation to their length. The first upper premolar is greatly reduced, subequal in size with the first upper incisor.

Dental formula: i 2/2 c 1/1 pm 3/3 m 2/3 = 34.

Measurements: Based on specimens of both sexes from throughout the indian subcontinent.

	mean	range	s	n
HB:	124.6	102.0 – 148.0	10.9	45
T:	15.9	8.0 – 26.0	3.0	45
HF:	18.9	15.0 – 25.0	1.9	44
FA:	80.7	74.0 – 90.0	3.0	39
E:	20.8	18.0 – 23.0	1.5	43
GTL:	37.3	34.9 – 40.4	1.3	27
CBL:	35.7	33.5 – 38.8	1.3	26
ZB:	22.5	20.2 – 24.8	1.1	32
BB:	15.3	14.4 – 16.5	0.5	37
IC:	7.6	6.9 – 8.5	0.5	38
PC:	8.3	6.9 – 9.5	0.6	37
$C\text{-}M^2$	14.2	13.5 – 15.2	0.5	24
$C\text{-}M_3$	15.8	14.8 – 17.2	0.6	25
M:	29.5	27.6 – 32.1	1.0	39

Ecology: *Rousettus leschenaultii* has a wide habitat tolerance, with an altitudinal range of 0-1000 metres (Bhat 1974) and an ability to survive in both arid and humid climes. Favoured roosts include caves, deserted buildings and tunnels. Unlike *Cynopterus* and *Pteropus*, it does not roost in trees. Colony size varies from 2 to several thousand individuals and the sexes are not segregated. It feeds primarily on fruits and flowers and additionally may take small fish (Ghose and Ghosal 1984). Some populations migrate seasonally in search of food.

Biology: According to Gopalakrishna and Choudhari (1977) who studied populations in Maharashtra, females may have two pregnancies in quick succession during the year. the first starts in the second week of November and terminates in the middle of March, although a few become pregnant

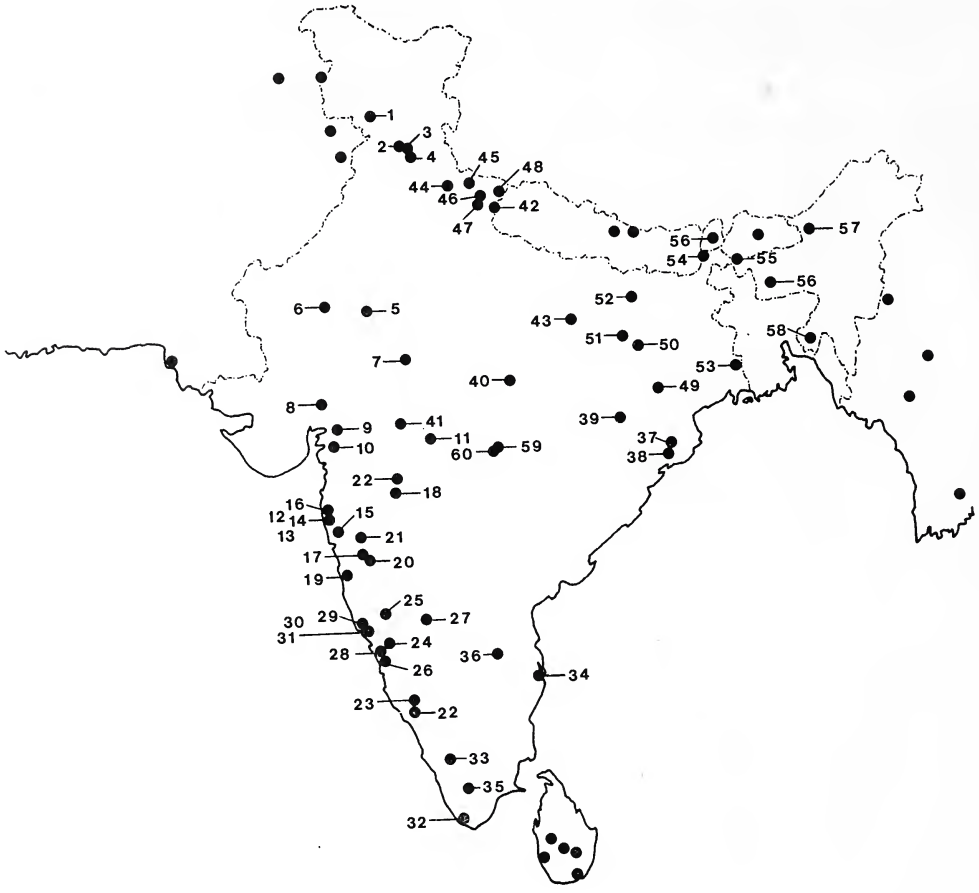


Fig. 1: *Rousettus leschenaultii* has a widespread distribution, extending from Sri Lanka, Pakistan, India and Nepal to Burma, Vietnam, southern China, Java and Bali.

Records from INDIA include Jhajjar Kotli [1], (Chakraborty, 1983) in **Kashmir & Jammu**; the districts of Kulu [2]; Kangra [3] and Mandi [4], (Bhat *et al.*, 1983) in **Himachal Pradesh**; Nasirabad [5], (Andersen, 1912); Jodhpur [6], (LACM coll.); Gagaron Ka Kila [7], (Sinha, 1980) in **Rajasthan**; Mehmadabad [8]; Baroda [9], (Brosset, 1962a); Broach [10], (Sinha, 1981) in **Gujarat**; Chikalda [11]; Elephanta [12]; Jogeshwari [13]; Kanheri [14]; Khandala [15]; Alibag [16]; Mahableshwar [17]; Aurangabad [18]; Ratnagiri [19], (Brosset, 1962a); Marathwada [nl], (Gopalakrishna & Madhavan, 1970); Satara [20], (Sinha, 1980); Poona [21], (Rookmaaker & Bergmans, 1981); Ellora [22], (this paper); Mansar [59], (Bhide & Gupta, 1986); Kandri [60], (Karim & Gupta, 1986) in **Maharashtra**; Virajpet [22]; Nagarhole [23], (Ryley, 1913b); Krishnapur [24]; Belgaum [25]; Gersoppa [26]; Hampi [27], (Brosset, 1962a); Muroor [28], (Sreenivasan & Bhat, 1974) in **Karnataka**; Margao [29]; Poinguinam [30], (Agrawal, 1973); Vaddem Bardez [31], (BNHS coll.) in **Goa**; Trivandrum [32], (Sinha, 1980); Silent Valley [33], (Das, 1986) in **Kerala**; Zakampatti [nl], (Sinha, 1980); Madras [34], (Rookmaaker & Bergmans, 1981); Travancore [35], (BNHS coll.) in **Tamil Nadu**; Koduru [36], (BMNH coll.) in **Andhra Pradesh**; Khandagiri [37], (Sinha, 1980); Bhubaneswar [38]; Koira [39], (Rookmaaker & Bergmans, 1981) in **Orissa**; Lamataghat [40], (Khajuria, 1979); Mandu [41], (Brosset, 1962a) in **Madhya Pradesh**; Tanakpur [42], (Wroughton, 1914); Chunar [43], (HZM coll.) and the districts of Dehra Dun [46]; Pauri [45]; Almora [46]; Naini Tal [47]; Pithoragarh [48], (Bhat, 1974) in **Uttar Pradesh**; Chaibassa [49], (Sinha, 1980); the districts of Hazaribag [50]; Aurangabad [51] and Patna [52], (Sinha, 1986) in **Bihar**; Calcutta [53], (Rookmaaker & Bergmans, 1981); Pedong [54]; Hasimara [55], (BMNH coll.) in **West Bengal**; 17 km wsw of Mangan [56], (Ghose & Ghosal, 1984) in Sikkim; Siju Cave [56], (Sinha, 1980) in **Meghalaya**; Sei Josa [57], (Rookmaaker & Bergmans, 1981) in **Arunachal**; Kanchanpur [58], (Rookmaaker & Bergmans, 1981) in **Tripura**. Extralimital localities based on Roberts (1977) for PAKISTAN; Scully (1887) and BMNH coll. for NEPAL; Chakraborty (1975) for BHUTAN; Ryley (1914b), Wroughton (1915b) and Phillips (1924) for SRI LANKA and Wroughton (1915a), Carter (1943), Sinha (1980) and Das (1986) for northern BURMA.

NB: [nl] = not located.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality (Date)	Size of Colony	No. of specimens taken	Nature of biotope
Aurangabad (3 March)	Colony of about 100 individuals	2	In drainage tunnel beneath Bibi Ka Maqbara Mosque
Ellora (4 March)	Colony of about 150 individuals	0	In cave No. 29
Mandu (12 March)	Vast colony of several thousand individuals	2	In cellars of Champa Baoli
Mahableshwar (28 March)	Colony size not known probably considerable	2	In Robbers Cave a natural cave in a forested area.

in December and deliver their young in April or early May; the second starts soon after parturition and terminates at the end of July. Gestation lasts about 125 days and there is generally only one foetus. Females reach sexual maturity after five months and males after fifteen months. Infant mortality is high.

Discussion

This species appears to be flourishing and has no doubt benefited from the increased agricultural activity of man. Brosset (1962a) reported that in February several colonies were found in the mosque and ruins of Mandu, with a total number of individuals estimated at between 1000 and 2000. Thirty years on and it appears to have consolidated its position into one huge colony of several thousand individuals in the extensive cellars of the Champa Baoli. In so doing, it has replaced a vast colony of *Hipposideros lankadiva* which Brosset (1962b) estimated to number between 5000 and 7000 individuals. At Aurangabad, a medium-sized colony of about 100 individuals was located in the drainage tunnel beneath the Bibi Ka Maqbara Mosque. Brosset (1962a) had recorded a small colony of 8 to 10 individuals in the nearby Buddist caves, but it was no longer present in this latter locality. The colony in cave No. 29 at Ellora was not noted by Brosset (1962a); the cave is relatively undisturbed and provides an ideal habitat for this species. The status of the colony at Robbers' Cave near Mahabaleshwar appears unchanged. However, it was not found at Elephanta. Possibly increased pressure from tourism has displaced it from these artificial caves.

Status: *Rousettus leschenaultii* has adapted well to man-made changes to the natural biotope. It requires no special protection or conservation measures. More detailed studies may suggest that it is gradually displacing the less adaptable Microchiropterans from a number of their traditional roosts and consequently some future control of its population size may prove to be desirable.

Pteropus giganteus (Brunnich, 1782) – Indian flying fox

Vespertilio gigantea Brunnich, 1782: Dyrenes Historie, 1: 45. Bengal, India.

External characters: This is the largest Fruit bat known to occur on mainland India. It is commonly seen hanging by its hind feet from tall trees with its massive wings wrapped around its body. The wings arise from the sides of the dorsum and consequently there is a narrowing of the dorsal pelage. There is no tail. The hind feet are large with strong black claws. The ears are essentially naked, dark brown or black in colour and conical in shape. The muzzle is well haired and the nostrils clearly defined. The pelage is a rich chestnut brown on the crown of the head. On the nape of neck, it varies from a light yellowish tan to a deeper chestnut brown. It is relatively darker around the eyes and mouth. The pelage on the posterior shoulders and dorsal region is short, sparse and black with some paler hair tips. There is a clear line of demarcation on the shoulders between the chestnut hairs of the head and neck and the dark hairs of the dorsum. The belly is most variable in colour, apparently independent of age, sex or season; it ranges from pale tan to deep orange-red chestnut brown.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality (Date)	Size of Colony	No. of specimens taken	Nature of biotope
Aurangabad (3 March)	Many individuals	0	Roosting in Banyan tree in city
Mandu (12 March)	Large colony, in excess of one hundred individuals	1	Roosting in mature trees near open water

NB. Colonies were seen in many other localities but no detailed notes were taken.

Cranial and dental characters: The skull is massive with a long rostrum and well developed paroccipital processes. The occipital region is subtubular, although the lambda still forms the most posterior part of the skull. The sagittal crest is present but weak. The post orbital constriction is variable in width, considerably narrower than the interorbital width in some specimens and subequal to it in others. The first upper premolar is often deciduous. The first lower incisor is usually distinctly smaller than the second. Both m^2 and m_3 are greatly reduced.

Dental formula: i 2/2 c 1/1 pm 3/3 m 2/3 = 34.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	267.3	198.0 – 300.0	198.0	53
HF:	48.4	35.0 – 58.0	3.3	54
FA:	175.3	169.0 – 183.0	5.8	4
E	39.9	35.0 – 45.0	2.2	54
GTL:	72.1	66.8 – 77.3	2.2	44
CBL:	69.8	64.8 – 74.9	2.4	50
ZB:	39.2	34.0 – 44.0	2.4	50
BB:	24.7	23.4 – 25.8	0.6	51
IC:	10.0	8.9 – 11.6	0.6	57
C-M^2:	26.9	24.5 – 29.0	1.1	55
C-M_3:	29.6	26.8 – 33.0	1.8	52
M:	56.0	51.9 – 60.0	2.0	59

Ecology: *Pteropus giganteus* is a colonial species that lives in large diurnal

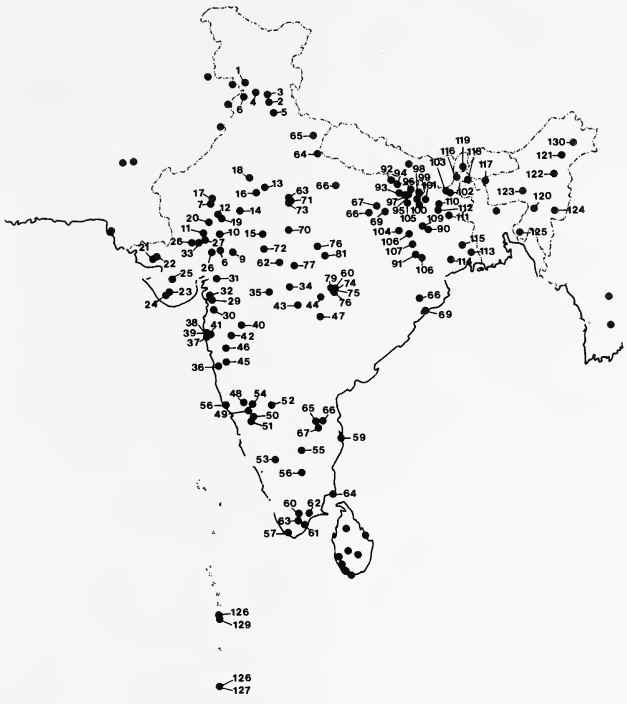


Fig. 2: *Pteropus giganteus* has a widespread distribution extending from Pakistan, India and Sri Lanka through to Burma and south-west China.

Records from INDIA include Jhajjar Kotli [1], (Chakraborty, 1983) in **Jammu & Kashmir**; Kotla [2], (Breadon, 1932); Kulu [3], (Ferrar, 1934); Kangra [4], (Sinha, 1980); Simla [5], (BNHS coll.) in **Himachal Pradesh**; Gurdaspur District [6], (Breadon, 1932) in **Punjab**; Balsamand [7]; Dungarpur [8]; Banswara [9]; Parsad [10]; Mount Abu [11]; Berah [12]; Naga [13]; Nasirabad [14]; Jhalawar [15], (Sinha, 1980); Jaipur [16], (Prakash, 1961); Jodhpur [17]; Jhunjhunu [18]; Pali [19]; Sirohi [20], (Advani, 1982b) in **Rajasthan**; Bhuj [21]; Charwa [22], (Wroughton, 1912a); Junagadh [23]; Baradia [24]; Rajkot [25], (Ryley, 1913b); Deesa [26]; Danta [27], (Ryley, 1914a); Himatnagar [28]; Sultanabad [29]; Silvassa [30], (Sinha, 1981); Baroda [31]; Surat [32], (Advani, 1982a); Palanpur [33], (BNHS coll.) in **Gujarat**; Pili Sipna Valley [34]; Asirgarh [35]; Siwal [nl], (Wroughton, 1912a); Patan [36], (Wroughton, 1916a); Bombay [37]; Malad [38]; Thana [39], (McCann, 1934); Belapur [40]; Kalyan [41]; Ahmednagar District [42], (McCann, 1934); Amraoti [43]; Nagpur [44], (Moghe, 1951); Satara [45]; Poona [46], (Bastawde & Mahabal, 1976); Chanda [47], (Sinha, 1980) in **Maharashtra**; Avatgi [48]; Devikop [49]; Hawsbhavi [50]; Honkan [51], (Wroughton, 1912b); Vijayanagar [52], (Wroughton, 1913); Seringapatam [53], (Ryley, 1913a); Dharwar [54]; Kolar [55], (Sinha, 1980) in **Karnataka**; Molem [56], (Agrawal, 1973) in **Goa**; Trivandrum [57], (Sinha, 1980) in **Kerala**; Salem [58], (Sinha, 1980); Madras [59], (BMNH coll.); Keelarajakularaman [60]; Sri Vaikundam [61]; Ramanathapuram [62], (Marimuthu, 1988); Mudavaram [63]; Point Calimere [64], (BNHS coll.) in **Tamil Nadu**; Cuddapah [65], (Sinha, 1980); Balapalli Range [66]; Palkonda Hills [67], (BNHS coll.) in **Andhra Pradesh**; Narsinghpur [68], (Moghe, 1951); Chilka Lake [69], (Sinha, 1980) in **Orissa**; Guna [70]; Bhind [71]; Agar [72]; Gwalior [73]; Mukhi [74]; Supkhar [75], (LACM coll.); Balaghat [76], (Sinha, 1980); Sohagpur [77]; Narsingarh [78]; Ouda [79]; Sonawanee [80], (Wroughton, 1913); Jabalpur [81], (Khajuria, 1979); Sehore [82], (BMNH coll.); Movar [83], (BNHS coll.) in **Madhya Pradesh**; Philibhit [84], (Wroughton, 1914); Kumaun [85]; Lucknow [86]; Varanasi [87], (Sinha, 1980), Mirzapur [88], (HZM coll.) in **Uttar Pradesh**; Chainpur [89]; Nimiaghat [90]; Luia [91], (Wroughton, 1915b); and the districts of West Champaran [92]; Siwan [93]; East Champaran [94]; Muzzaffarpur [95]; Sitamarhi [96]; Madhubani [97]; Darbhanga [98]; Samastipur [99]; Begusarai [100]; Saharsa [101]; Purnea [102]; Katihar [103]; Palamau [104]; Patna [105]; Hazaribagh [106]; Ranchi [107]; Singhbhum [108]; Giridih [109]; Bhagalpur [110]; Santal Pargana [111], (Sinha, 1986); Bongoan [nl]; Amarpura [112], (Sinha, 1980) in **Bihar**; Calcutta [113], (LACM coll.); Salbani [114], (Wroughton, 1915b); Burdwan [115]; Duars [nl]; Siliguri [116], (Sinha, 1980); Hasimara [117]; Jalpaiguri [118], (BMNH coll.) in **West Bengal**; Gangtok [119], (Ghosal & Ghose, 1984) in **Sikkim**; Cachar [120], (Andersen, 1912); Doom [121]; Golaghat [122], (BNHS coll.); Sadiya [130], (Kurup, 1968) in **Assam**; Shillong [123], (BMNH coll.) in **Meghalaya**; Kochim-kooleh [124], (Andersen, 1912) in **Manipur**; Amarpur [125], (Agrawal & Bhattacharyya, 1977) in **Tripura**. Localities in the **Maldives** include Hululay Island [126]; Gan [127]; Addu Atoll [128] and Male Atoll [129], (BMNH coll.). Extralimital localities are based on Roberts (1977) for PAKISTAN; Scully (1887) for NEPAL; Siddiqi (1961) for BANGLADESH; Wroughton (1915b) and Phillips (1924) for SRI LANKA and Sinha (1980) for northern BURMA.

roosts which may comprise hundreds or even thousands of individuals. Colonies are usually located in close association with man and tend to be found in well established trees in cities and villages. The diet is primarily comprised of fruits. In the non-fruiting season, individuals are known to chew soft leaves and twigs and eat flowers (Sinha 1986). Within a colony, each male has a rank and a particular resting place; young males live separately from March to October. Colonies may break up into smaller feeding groups at sunset and immense distances, sometimes in excess of 20 km, may be covered in search of food. During the summer, individuals flap their wings and salivate on their bodies in an attempt to reduce body temperature (Neuweiler 1969). Local, seasonal migration may also occur, as individuals seek cooler localities in summer or more productive areas (Bastawde and Mahabal 1976).

Biology: In Madras, the mating season is from July to the beginning of October; copulation occurs three times in sequence and individuals may trigger a mass copulation within a colony. Females collect in the upper branches to give birth and the young are born in March in Tamil Nadu. For the first few weeks they are carried by their mothers but from May onwards they are left alone in the roost (Neuweiler 1969). Females in Bihar in April were mostly pregnant, each having a single foetus (Sinha 1986).

Discussion

Since neither this paper nor that of Brosset (1962a) made a detailed study of this taxon, it is not possible to assess the change of status of this species over the past 30 years.

Status: Empirical evidence suggests that this continues to be a common species in no need of special conservation measures.

Cynopterus sphinx (Vahl, 1797)— Short-nosed Fruit bat

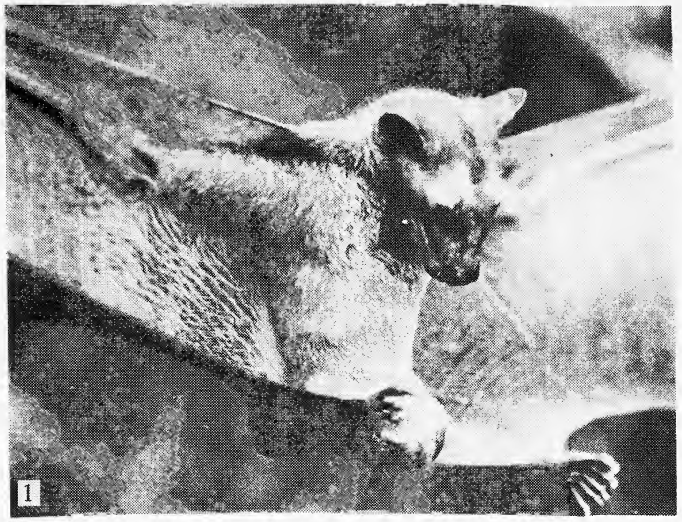
Vespertilio sphinx Vahl, 1797 — Skrifter Nat-Selsk. Kiobenhaven, 4(1): 123. Tranquebar, Madras, India.

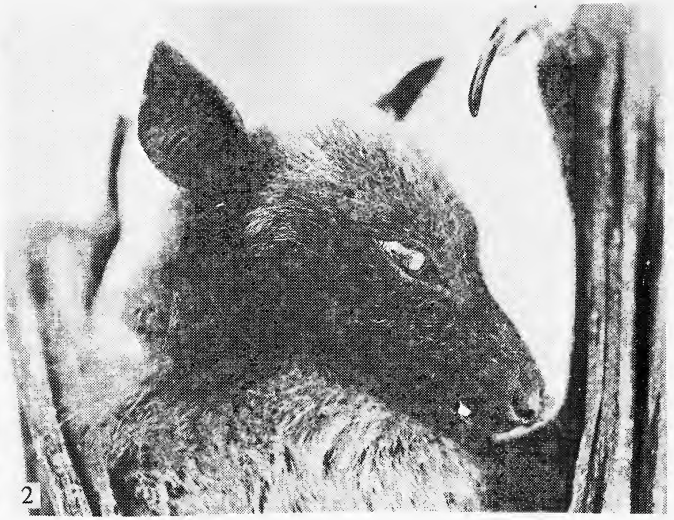
External characters: This is a medium-sized Fruit Bat with a very short tail. The pelage of males is a rich orange brown on the chin, anterior part of the shoulders, and the sides of the chest, belly and thighs. In females, the collar tends to be a more tawny brown. The forehead and nape of the neck are a rich russet brown. The posterior back is grey brown; the belly is a paler grey. The males have neck tufts comprised of a semi-rigid ruff of hairs. The ears are essentially naked, mocha brown in colour but with characteristically well defined pale anterior and posterior borders. The wing and interfemoral membranes are dark brown but with the fingers noticeably pale.

Cranial and dental characters: The rostrum is short and broad and the zygomata are relatively heavy in comparison to those of *Rousettus leschenaultii.* The postorbital constriction is well developed and the braincase is relatively small. The dentition is reduced with both m^2 and m_3 absent. The second upper premolar is equal in crown area to the third and is relatively much larger than that of *Rousettus.* The mandibular cheekteeth are relatively heavy in comparison to those of *R. leschenaultii.*

Dental formula: i 2/2 c 1/1 pm 3/3 m 1/2 = 30.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.





1. *Rousettus leschenaultii*; 2. *Pteropus giganteus*; 3. *Cynopterus sphinx*; 4. *Rhinolophus hardwickii*.

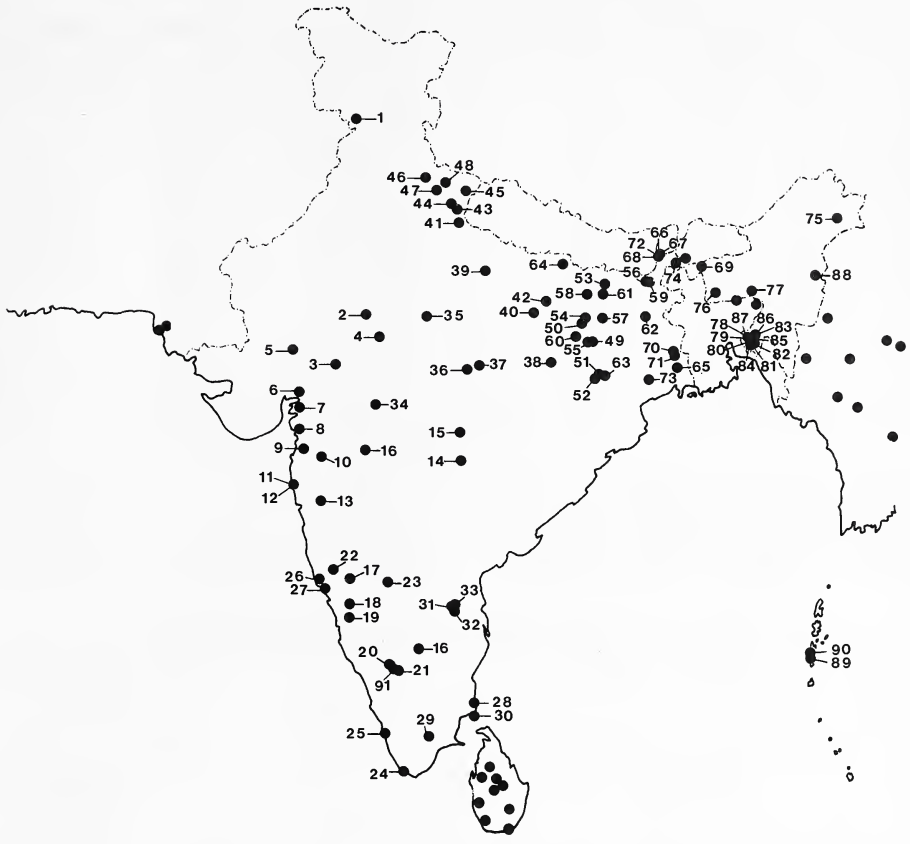


Fig. 3: *Cynopterus sphinx* is widely distributed with a range that extends from India and Sri Lanka to southern China, Malaya, Java, Lesser Sunda Island, Borneo and Sulawesi.

Records from INDIA include Jhajjar Kotli [1], (Chakraborty, 1983) in **Jammu & Kashmir**; Bundi [2]; Banswara [3]; Jhalawar District [4], (Advani, 1982) in **Rajasthan**; Danta [5], (Ryley, 1914a); Anand [6]; Vedtial [7], (Brosset, 1962a); Surat [8]; Silvassa [9], (Sinha, 1981) in **Gujarat**; Nasik [10]; Bandra [11]; Bombay [12], (Andersen, 1912); Poona [13]; Chanda [14], (Brosset, 1962a); Nagpur [15], (Das & Sinha, 1971); Ajanta [16], (this paper) in **Maharashtra**; Bangalore [16]; Mysore [91], (Das & Sinha, 1971); Dharwar [17], (Andersen, 1912); Sirsi [18]; Honawar [19], (Wroughton, 1913); Seringapatam [20], (Ryley, 1913a); Virajpet [21], (Ryley, 1913b); Belgaum [22]; Hampi [23], (Brosset, 1962a) in **Karnataka**; Trivandrum [24], (Andersen, 1912); Cochin [25] in **Kerala**; Margao [26]; Valpoi [27], (Agrawal, 1973) in **Goa**; Tranquebar [28], (type locality of *sphinx*); Madurai [29], (Sinha, 1980); Point Calimere Sanctuary [30], (Balasubramanian, 1988) in **Tamil Nadu**; south Cuddapah [31], (Phillips, 1924); Koduru [32]; Balapalli [33], (BNMH coll.) in **Andhra Pradesh**; Nimar [34], (Wroughton, 1912b); Orcha [35], (Brosset, 1962a); Jabalpur [36]; Shahpura [37], (Khajuria, 1979); Ambikapur [38], (Khajuria, 1984) in **Madhya Pradesh**; Lucknow [39] (type locality of *gangeticus*); Mirzapur [40], (HZM coll.); Philibhit [41], (BMNH coll.); Banaras [42], (Khajuria, 1953); and the districts of Naini Tal [43]; Almora [44]; Pithoragarh [45]; Dehra Dun [46]; Pauri [47] and Chamoli [48], (Bhat, 1974) in **Uttar Pradesh**; Barkagaon [49]; Singar [50]; Luia [51]; Koira [52], (Wroughton, 1915b) and the districts of Darbhanga [53]; Gaya [54]; Hazaribag [55]; Katihar [56]; Munger [57]; Patna [58]; Purnea [59]; Rohtas [60]; Samastipur [61]; Santal Pargana [62]; Singhbhum [63] and West Champaran [64], (Sinha, 1986) in **Bihar**; Calcutta [65], (Andersen, 1912); Singla [66], (Wroughton, 1916b); Tong Song [67], (Wroughton, 1916c); (specimens from Pashok listed in Wroughton, 1916c were subsequently referred to *Megaerops*, Hill, 1983); Gopalahara [68]; Bharna Ghari [nl]; Hasimara [69], (BMNH coll.); Madanpur [70]; Parmadan [71], (Das & Sinha, 1971); Darjeeling [72]; Duars [nl], (Sinha, 1980); Salbani [73], (Wroughton 1915b); Jalpaiguri [74], (Bhat, 1974) in **West Bengal**; Namdapha [75], (specimens referred to *C. angulatus* in Saha, 1985) in **Arunachal Pradesh**; Garo Hills [76], (Kemp, 1924); Cheerapunji [77], (Sinha, 1980) in **Meghalaya**; Agartala [78]; Charilam [79]; Garjee [80]; Abhoya [81]; Teliamura [82]; Ampi [83]; Ambassa [84]; Ganganagar [85]; Chailingta [86]; Kanchanpur [87], (Agrawal & Bhattacharyya, 1977) in **Tripura**; Naga Hills [88], (Sinha, 1980) in **Nagaland.** It is also known from Port Blair [89], (Chaturvedi, 1969) and Mandapahar [90], (J.E. Hill pers. comm.) in the **Andaman Islands**. Extralimital localities are based on Roberts (1977) for PAKISTAN; BMNH coll. and Ellerman & Morrison-Scott (1951) for BANGLADESH; Ryley (1914a), Wroughton (1915b) and Phillips (1924) for SRI LANKA; Saha (1980) for BHUTAN; Ryley (1914a) and Wroughton (1915a, 1916a, 1916c) for northern BURMA.

	mean	range	s	n
HB:	98.1	82.0 – 114.0	8.9	53
T:	12.3	5.0 – 18.0	3.5	52
HF:	15.6	10.0 – 18.0	1.3	53
FA:	74.0	69.0 – 82.0	2.7	9
E:	20.8	18.0 – 24.0	1.5	49
GTL:	32.4	29.8 – 34.9	1.3	48
CBL:	30.9	28.5 – 33.0	1.4	42
ZB:	20.7	18.3 – 23.1	1.1	46
BB:	13.4	11.1 – 14.8	0.6	56
IC:	6.4	5.4 – 7.7	0.5	59
C-M^1:	11.0	9.2 – 12.2	0.6	57
C-M_2:	12.2	9.7 – 13.5	0.9	61
M:	24.9	22.6 – 27.5	1.2	62

Ecology: *Cynopterus sphinx* is a common Fruit bat generally found in small, single sex colonies of three to four individuals (Khajuria 1979). In the breeding season groups of 5-10 males and 10-15 females are formed (Krishna and Dominic 1985). It most often roosts on the underside of the leaves of palms or concealed in the crevices of banyan, peepul, palm or coconut trees (Chakraborty 1983); it may also frequent deserted buildings (Brosset 1962a). It is found in heavy forest, cultivated areas and even in big cities such as Bombay. Its flight is low and comparatively fast and it uses its acute sense of smell to detect its food. It feeds on the fruits of some 25 plant species, including guava, ber, mango, date palm, custard apple, lychee and banana; it is also known to eat leaves and to collect nectar from flowers (Balasubramanian 1989). When feeding, it seldom clings to branches but tends to maintain itself in the air with swift wing beats, biting at the fruits in flight and devouring them on the wing.

Biology: In Maharashtra, there are two periods of sexual activity, one during September-October, the other during February-March. Gestation lasts for between 115 and 125 days and individuals are born in February-March and June-July (Sandhu 1988). There is usually only one foetus and full adult size is achieved in two months (Krishna and Dominic 1983). Females may be both lactating and pregnant.

Discussion: It is not possible to determine if there have been any significant changes in the population size of this species during the last 30 years. The secretive nature of the roosts make a direct comparison with the findings of Brosset (1962a) impossible.

Status: Anecdotal evidence suggests that this is a common species, even within the confines of urban Bombay. Further studies to substantiate these suggestions would be of value.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992:

Locality (Date)	Size of Colony	No. of specimens taken	Nature of biotope
Ajanta (5 March)	Not known	1	Caught in mist net in river valley

Suborder MICROCHIROPTERA

Family RHINOPOMATIDAE

Rhinopoma hardwickii Gray 1831 - Lesser Mouse-tailed bat

Rhinopoma hardwickii Gray, 1831: Zoological Miscellany, 1: 37. India.

External characters: This is a medium-sized Microchiropteran with a characteristically long, slender tail, the greater part of which extends free from the membrane. The tail, on average, is equal to the length of the head and body and usually exceeds forearm length. In *Rhinopoma microphyllum*, also found in India, tail length (mean= 58.8 mm; 50-78 mm) is usually less than both forearm length (67.9 mm; 58-74 mm) and head and body length (75.3 mm; 65- 84 mm). The face, ears and connecting membrane between the ears on the forehead are all naked and fleshy brown in colour. A small, but well defined triangular dermal ridge is present on the snout and there is a well developed pit at the base of the muzzle between the large eyes. The pelage is a uniform light grey brown on the back and is slightly paler on the belly. The lower back and belly are naked. The flight is relatively high but also weak and slow and is accompanied with a peculiar fluttering of the wings (Wroughton 1913).

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality (Date)	Size of Colony	No. of specimens taken	Nature of biotope
Rajkot (March 18)	Small colony-exact number not known	1	Secreted in cracks in low ceiling of building adjacent to Kirisara Fort

Cranial and dental characters: The skull is characterised by the large nasal inflations present on either side of the rostrum. These inflations are more developed than those of *R. microphyllum*, the skull of which is significantly larger with a mean greatest length of 20.9 mm (19.2-22.3 mm). The median hollow between the nasal inflations is also more developed than that of *R. microphyllum*. The sagittal crest, although present is less prominent than that of the larger species. The dentition is unremarkable; it is smaller than that of *R. microphyllum*, the upper toothrow of which averages 7.5 mm (6.8-8.0 mm) in length.

Dental formula: i 1/2 c 1/1 pm 1/1 m 3/3 = 28.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	66.7	55.0 – 74.0	4.2	40
T:	66.7	56.0 – 77.0	5.5	40
HF:	13.4	11.0 – 15.0	1.2	34
FA:	60.0	54.0 – 64.0	2.2	29
E:	19.2	16.0 – 21.0	1.0	40
GTL:	18.7	17.5 – 19.7	0.5	31
CBL:	17.1	16.1 – 18.1	0.5	29
ZB:	10.9	10.2 – 11.6	0.4	34
BB:	8.2	7.8 – 8.6	0.2	43
PC:	2.8	2.6 – 3.2	0.2	45
C-M^3:	6.4	6.0 – 6.8	0.2	46
C-M_3:	7.0	6.5 – 7.5	0.3	43
M:	12.8	11.8 – 13.6	0.4	45

Ecology: *Rhinopoma hardwickii* favours dry and semi-desert areas, sub-tropical dry evergreen forests and tropical thorn forests (Siddiqi 1961). It is a sociable species usually found in small colonies of between four and

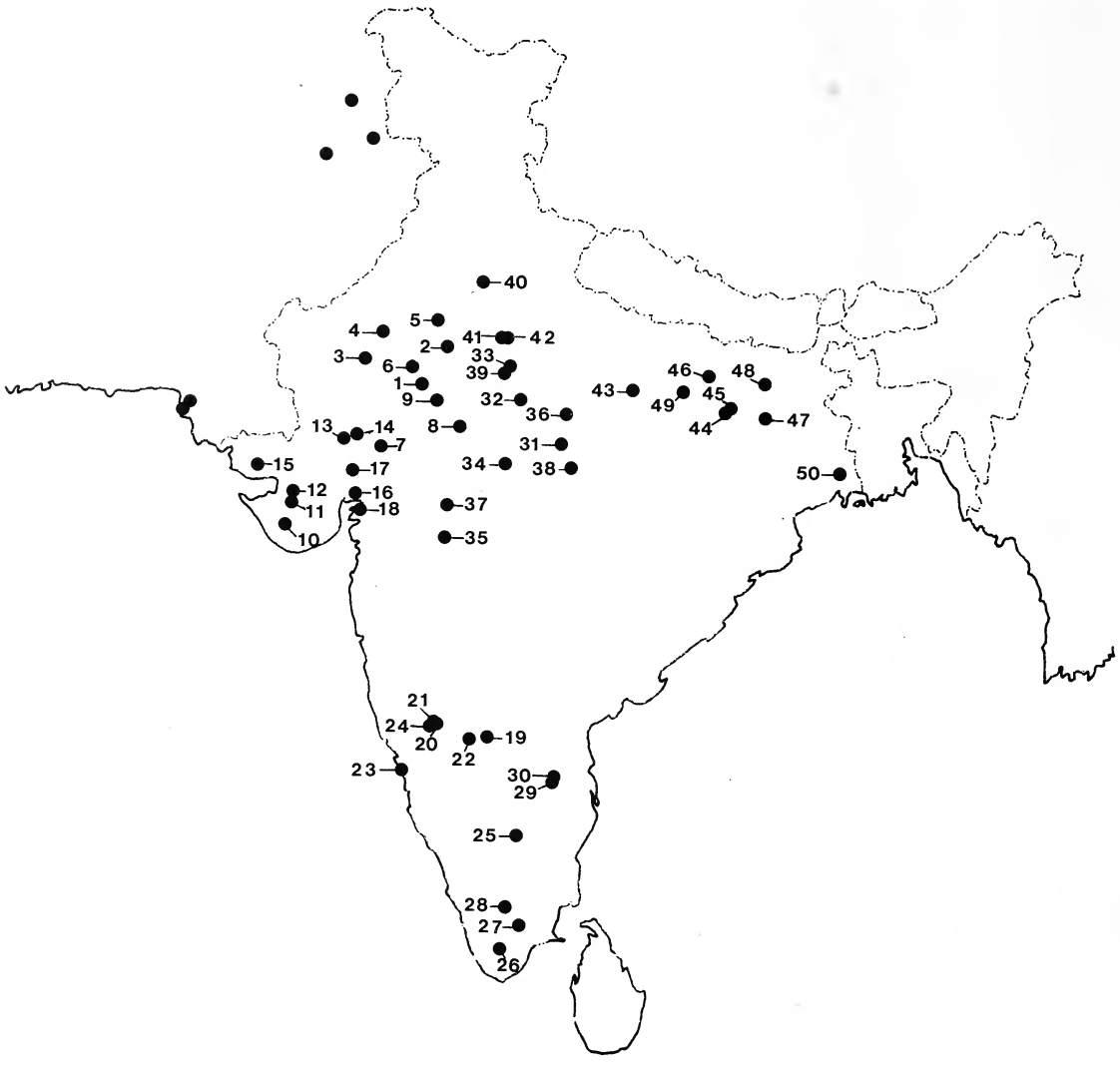


Fig. 4: *Rhinopoma hardwickii* has a widespread distribution ranging from Niger, Morocco and Mauritania to East Africa, Arabia, Iran, Afghanistan, Pakistan, India, and possibly Burma and southern Thailand, (Hill, 1977).

Records from INDIA include Nasirabad [1], (BMNH coll.); Jaipur [2], (BNHS coll.); districts of Jodhpur [3]; Nagaur [4]; Jhunjhunu [5]; Ajmer [6]; Dungarpur [7]; Jhalawar [8] and Bundi [9], (Sinha, 1980) in **Rajasthan**; Junagadh [10]; Rajkot [11]; Vankaneer [12], (Ryley, 1913b); Palanpur [13]; Lunwa [nl]; Danta [14], (Ryley, 1914a); Bhuj [15]; Anand [16]; Ahmedabad [17]; Vedtial [18], (Brosset, 1962a) in **Gujarat**; Bellary [19], (Wroughton, 1913); Pattadkal [20]; Badami [21]; Vijayanagar [22], (Brosset, 1962a); Gokarna [23], (Bhat & Sreenivasan, 1972); Gadag [24], (BMNH coll.) in **Karnataka**; Dharmapuri Range [25]; Travancore [26], (BNHS coll.); Madurai [27], (Kock & Felten, 1980); Kanavi Katha Bootham [nl], (Usman, 1988); Palni Hills [28], (BMNH coll.) in **Tamil Nadu**; Palkonda Hills [29], (BNHS coll.); Koduru [30], (BMNH coll.) in **Andhra Pradesh**; Narsingarh [31], (Wroughton, 1913); Orcha [32]; Gwalior [33]; Sanchi [34]; Asirgarh [35]; Khajurao [36]; Mandu [37], (Brosset, 1962a); Jabalpur District [38], (Khajuria, 1979); Ghatigaon [39], (BMNH coll.) in **Madhya Pradesh**; New Delhi [40], (Brosset, 1962a) in **Delhi**; Fatehpur Sikri [41]; Agra [42], (Brosset, 1962a); Allahabad [43], (BMNH coll.) in **Uttar Pradesh**; Singar [44], (Wroughton, 1915b); Gaya [45]; Bhojpur [46]; Giridih [47]; Munger [48]; Rohtas districts [49], (Sinha, 1986) in **Bihar**; Calcutta [50], (BMNH coll.) in **West Bengal**. Extralimital localities are based on BNHS coll., Siddiqi (1961) and Roberts (1977) for PAKISTAN.

100 individuals although Sinha (1986) reported 500 from a locality in Bihar and Usman (1988) 1500 from a single cavern in Madurai district. Colonies are thought to be sexually segregated (Brosset 1962a). Roosting sites include caves, houses, ruins and cracks amongst boulders. The bats impregnate the area with their characteristic smell. The diet includes moths, insects and beetles. Although this species does not hibernate, it does have periods of extended rest during which it lives off copious fat reserves. The reserves, that may double an individual's body weight, are formed in the post monsoon period (October) in north-west India when insects are plentiful. They are progressively utilised during the winter and spring and disappear during May-June. There is some temporal variation in the cycle of fattening between the different geographical areas of India (Brosset 1962a)

Biology: In Uttar Pradesh, copulation occurs during the last week of February and the first week of March; ovulation commences after 11 March and gestation lasts 95 to 100 days. Births of the single infants occur either in late June or early July; lactation lasts about two months and females reach sexual maturity at about 9 months (Banerjee and Karim 1982).

Discussion: During the March 1992 survey, *Rhinopoma hardwickii* was encountered once at Kirisara Fort near Rajkot. Brosset (1962a) located this species at sixteen sites. His records included four individuals in the Hindola Mahal ruins of Mandu in February; 70-80 individuals in the Dada Hari Well in Ahmedabad in November and 25-30 individuals at the same locality in June; 10-15 individuals were observed by him on the ceiling of a mosque in Ahmedabad in November. Previously, seven individuals were collected from the old fort of Junagadh in October 1912 (Ryley 1913b). All these localities were re-surveyed during the present study, but no trace of *Rhinopoma* was found.

Status: Although this is presumed to be a common species in India, our brief survey found it to be rare. As noted above, former colonies appear to have been deserted. One possible explanation is that *R. hardwickii* is a seasonal migrant and was temporarily absent from the sites previously surveyed by Brosset (1962a) and Ryley (1913b). However, there is also the possibility that there has been a significant fall in its population size. Further studies of Brosset's localities during the months of his original survey would help to determine the present status of this species.

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(to be continued)

BREEDING HABITS OF THE NILGIRI LAUGHING THRUSH *GARRULAX CACHINNANS* (JERDON)[1]

M.A. ISLAM[2]

(With six text-figures)

Key words: Nilgiri hills, *Garrulax cachinnans*, breeding season, nest destruction, repeat nest, incubation, brooding, nest sanitation.

The breeding habits of the Nilgiri laughing Thrush were studied in southern India between 1982 and 1984. Of the 62 nests studied 56 were built in indigenous and the remaining in exotic plants. Twenty four nests were built at 1-2 metres above ground. The birds destroy the nests after the nestlings leave the nest or if the eggs or nestlings are preyed upon. The clutch of two was laid between January and April. Both sexes incubate. Incubation period was 16-17 days and average nestlings weight 4 g. at hatching. Both parents swallow the faecal sacs. The average nestling period was 16.5 days. The breeding success for 1983 and 1984 was 64% and 56% respectively.

INTRODUCTION

There is no detailed study on the breeding biology of the Nilgiri Laughing Thrush. Brief description of different aspects of the breeding biology is available in Betham (1902), Baker (1932), and Ali and Ripley (1972). The present study describes the breeding biology in detail, based on field work in the Nilgiri hills (11°40′ N and 76°14′ E to 77′ E) of southern India. The Nilgiris have an area of about 2525 sq. km and consist of a group of hills ranging in height between 900 and 2635 metres above mean sea level. The natural vegetation consists of extensive grasslands covering rolling hills interspersed with numerous isolated, compact, and usually small woodlands are termed 'sholas' meaning tropical rain forest. Other than sholas the area has degraded types of Southern Montane Wet Temperate Forests which Champion and Seth (1968) termed as Evergreen scrub.

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MATERIAL AND METHODS

The study areas (Governor's Shola and Parson's Valley) were visited almost every day during the breeding season. Nests were located by observing the birds carrying nest material or food for the nestlings. Sometimes calls given by the bird at the nest helped in locating the nest. During the nesting period, *G. cachinnans* gave a alarm calls at my approach which also provided a clue to the nesting site. When the nest was located the following data were recorded: nesting plant, height of the nest from the ground, and nesting stage. When the eggs were found, they were numbered and dated with Indian ink, weighed with Pesola spring balance and measured with vernier callipers. The growth of the nestlings was recorded whenever possible. Observations at nests were made from a hide placed six to ten metres from the nest.

RESULTS AND DISCUSSION

Breeding season: During the period from December 1982 to April 1983 and December 1983 to August 1984, a total of 62 nests were

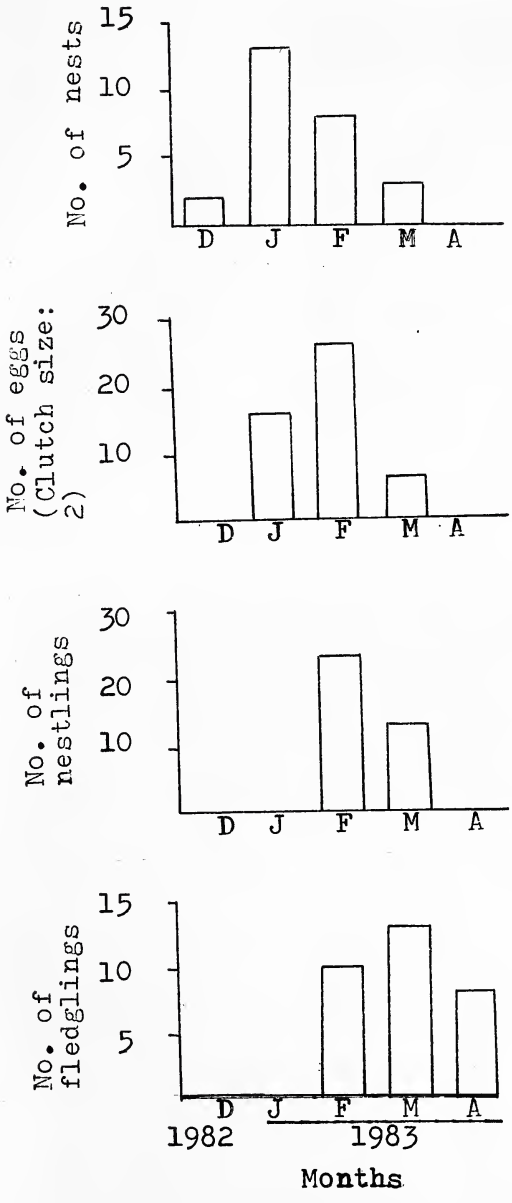

Fig. 1. Monthly distribution of nests, eggs, nestlings and fledglings of *G. cachinnans* during the 1983 breeding season.

studied at Governor's Shola and Parson's Valley. Hereafter, these priods will be referred to as the 1983 and 1984 breeding seasons.

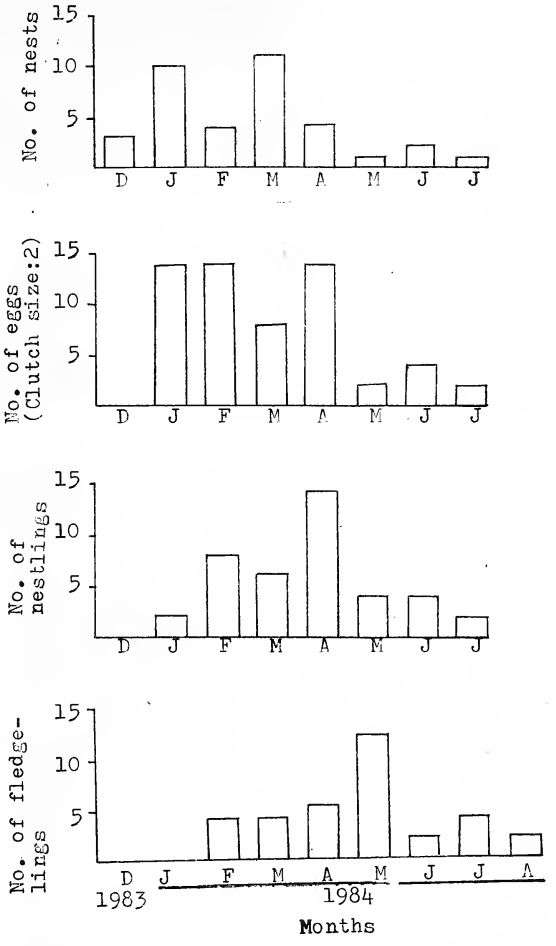

Fig. 2. Monthly distribution of nests, eggs, nestlings and fledglings of *G. cachinnans* during the 1984 breeding season.

Most of the clutches were laid between January and April (Figs. 1 and 2). Egg-laying occurred in 15 and 20 nests in January and February respectively. However, in March and April, eggs were laid in 14 nests and in May, July egg-laying occurred only in five nests. Nest ceased at the onset of the south-west monsoon (June to September).

Of the 62 nests observed in the two seasons, nine were destroyed by the birds

TABLE 1
HATCHING AND FLEDGING RECORDS OF *G. Cachinnans* DURING THE 1983 AND 1984 BREEDING SEASONS

Date of first nest building and no. of nests found		Date of first and last egg laying		No. of eggs and no. of nestlings		No. of nestlings fledged		Last nestling left the nest
1983	1984	1983	1984	1983	1984	1983	1984	1984
16 Dec. (1982	20 Dec. 1983	First: 9 Jan.	First 4 Jan.	Eggs: 48	Eggs: 58	n = 31 (64%)	n = 33 (56%)	*c.* 18 August
Nests: n = 26	n = 36		Last: 16 July	Nestlings: n = 36 (75%)	n = 40 (68%)			

themselves before egg laying. The breeding activities of *G. cachinnans* in the 1984 breeding season, from nest building (20 December) to last fledging (*c.* 18 August), lasted 34 weeks (Table 1). If the breeding season is calculated following Moreau (1964) and Lack (quoted by Perrins 1965) on the basis of first and last egg laying dates, then it is 27 weeks. Ali and Ripley (1972) put the breeding season of *G. cachinnas* as overall February to July, chiefly May and June. Carter and Davison (quoted by Baker 1932) gave the nesting season as February to May inclusive. Bates (quoted by Baker 1932) obtained two fresh eggs on 20 July.

Copulation: *G. cachinnas* was seen by me only in pairs, though Ali and Ripley (1972) noticed them in groups of a dozen or more. Only once a pair was seen to copulate, on a perch when the male was balancing on the female's back by constantly fluttering his wings. Time taken in mounting and dismounting was about six seconds. The pair started building their nest on 8 February, copulated (I have seen them copulating once, they might have copulated other times) on 21 February and laid the first egg on 26 February, 1984.

Nest site: Fifty three nests were found in sholas with thick undergrowth, preferably near streams or marshes. Nine nests were found in *Acacia* and *Eucalyptus* plantations mixed with shola species. All pairs (no. of nests = 48) nested within their territories; the birds have a tendency to build the nest on the edges of sholas close to roads and cattle trails. At least seven pairs built nests between two and seven metres from their roosting trees, while two pairs used the same nest tree in subsequent breeding seasons.

Of the 62 nests, 56 were built in indigenous and the remaining in exotic plants (Table 2). Though *Sarcococca* was the most abundant undergrowth, the favourite site was *Bambusa* spp. with 11 nests, *c.* 18% of the total. Twenty four nests (*c.* 39%) were built at 1-2 metres above ground mostly placed

TABLE 2
PLANTS USED FOR BUILDING NESTS BY *G. cachinnans*
(TOTAL NESTS = 62)

	Plants	Family	Frequency
1.	*Bambusa* spp.	GRAMINEAE	11
2.	*Sarcococca trinervia*	BUXACEAE	6
3.	*Syzygium montanum*	MYRTACEAE	5
4.	*Viburnum erubescens*	CAPRIFOLIACEAE	4
5.	*Ilex denticulata*	AQUIFOLIACEAE	4
6.	*Syzygium calophyllifolium*	MYRTACEAE	3
7.	*Piper* sp.	PIPERACEAE	3
8.	*Eurya japonica*	TERNSTROEMIACEAE	3
9.	*Mahonia nepaulensis*	BERBERIDACEAE	2
10.	*Rhododendron* sp.	ERICACEAE	2
11.	*Lonicera* sp.	CAPRIFOLIACEAE	2
*12.	*Acacia dealbata*	LEGUMINOSAE	2
*13.	*Ulex europaeus*	PAPILLIONACEAE	2
14.	*Microtropis ovalifolia*	CELASTRACEAE	1
15.	*Meliosma wightii*	SABIACEAE	1
16.	*Tylophora* sp.	ASCLEPIADACEAE	1
17.	*Cinnamomum* sp.	LAURACEAE	1
18.	*Symplocos* sp.	SYMPLOCACEAE	1
19.	*Asplenium* sp.	POLYPODIACEAE	1
20.	*Rubus ellipticus*	ROSACEAE	1
21.	*Toddalia asiatica*	RUTACEAE	1
22.	*Evodia lunurankenda*	RUTACEAE	1
23.	*Rhodomyrtus* sp.	MYRTACEAE	1
24.	*Oldenlandia* sp.	RUBIACEAE	1
*25.	*Eucalyptus globulus*	MYRTACEAE	1
*26.	*Eupatorium glandulosum*	COMPOSITAE	1

*Exotic species.

in a fork on the peripheral branches (Table 3). When built in more exposed places more care seemed to have been taken in selecting leafy sites, as also observed by Betham (1902). Pairs which have their first nest destroyed tend to change the height of their nest site when they rebuild, possibly to decrease the chance of predation, as also reported by Lack and Lack (1958) and Gaston (1973) for the long-tailed tit *Aegithalos caudatus*. In the 1984 breeding season, at Parson's Valley, a pair built nine nests to rear a single successful brood and every time the species of nest plant and height were different (Table 4).

Nest building: Prior to nest building, the male and female frequently visited the nest sites, where they spent more time, feeding, preening, giving contact calls and it appears that the site selection is a joint effort. The time spent for searching of nest site varied from one day to a week. Four pairs started building repeat nests within 24 hours of abandoning the previous nest.

Both sexes share in building the nest. At the beginning the birds build the base in a

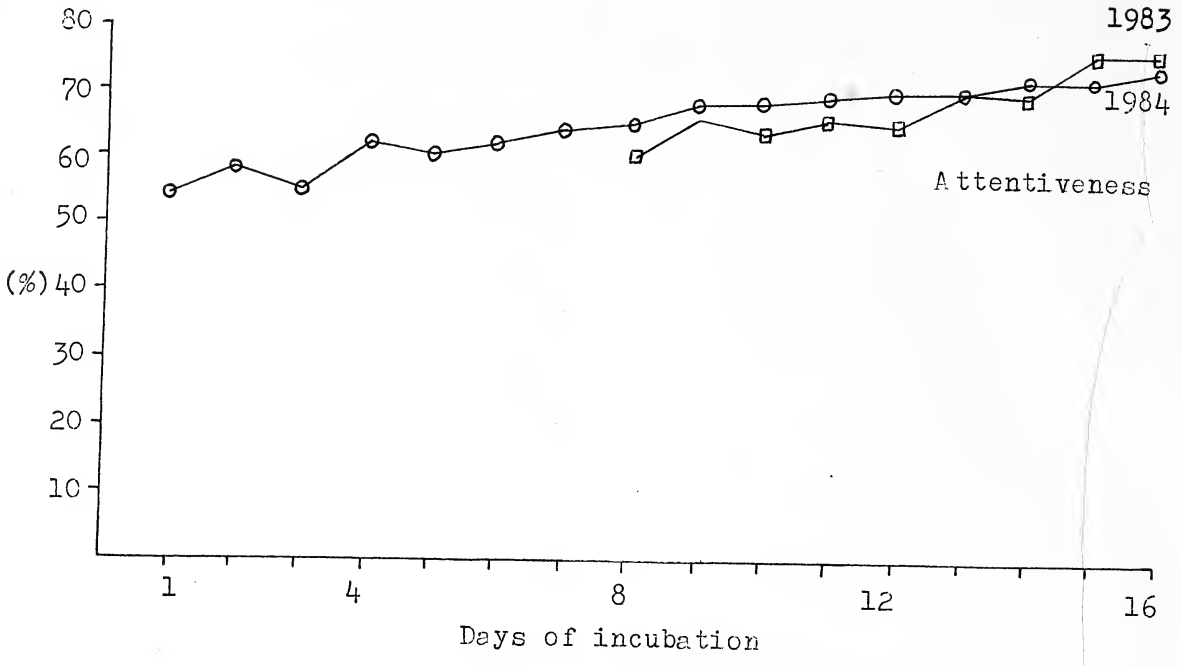

Fig. 3. Rate of incubation at two *G. cachinnans* nests in 1983 and 1984 breeding seasons.

TABLE 3
HEIGHT AND POSITION OF *G. cachinnans* NESTS

	n
Height abovve ground:	
0 – 1 m	16
1 – 2 m	24
2 – 3 m	12
3 – 4 m	3
4 m	7
	62
Position in plant:	43 (69%)
On the periphery	19 (31%)
In the centre	

fork, giving a general cup-shape to the nest with mosses, which are also used for attaching the nest rim to the branches. Then miscellaneous material such as dead leaves, wood, wool, paper, rootlets, cloth and thread are placed across the bottom and the side. Fine grasses, tendrils and hair are used for inner lining, above which feathers are added. The birds finally shape the nest by crouching and rotating their body in it.

Nest building activities were observed between 0700 and 1800 hrs. I observed the rate of transportation of nest materials by two pairs of laughing thrushes for 58 hours in Governor's Shola and Parson's Valley. Results (Table 5) show the preference for nest building was in the forenoon at Governor's Shola which is statistically significant $X^2 = 24.83$, d.f. 5, $p \leq 0.05$).

The duration of nest building observed for 24 nests was five to eighteen days (Table 6). The interval between completion of the nest and laying was one to five days. Birds completed nests faster as the days progressed. This was observed by Van Tyne and Berger

(1959) also in American goldfinch. In this bird, some built nests an average in 13 days during the first two weeks of July, whereas those building during the last two weeks of August required 5.6 days. Table 6 shows that the transportation of nest material was quicker in March than in January.

Mosses, available throughout the year, comprised *c.* 50% of total weight (n=11) of the nest. Several other birds such as blackbird *Turdus merula* and Nilgiri verditer and grey flycatchers (Ali and Ripley 1983), tickelle's blue flycatcher (Khan 1977) and white-eye also use mosses in the Nilgiris, perhaps to camouflage the nest. Four species of mosses namely, *Papillaria* sp., *P. fuscescens*, *Meteoriopsis formosana*, *Aerobryidium filamentosum* and three leafy liverworts, *Radula* sp., *Chiloscyphus* sp., and *Lejeunea* sp., were identified from 11 nests of *G. cachinnans*.

The composition of nests depends partly on the availability of the nest material (Table 7) and head hair, fur, twine, cotton and domestic fowl feathers. The average dry weight of 11 nests was 44 g (range 30-65 g). Measurements of diameter and depth of the 11 nests averaged 75 mm (range 67-87 mm) and 45 mm (range 33 - 52 mm) respectively.

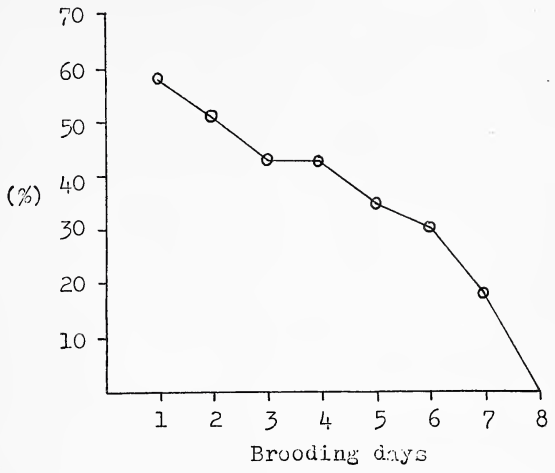

Fig. 4. Time spent in brooding at a *G. cachinnans* nest.

G. cachinnans destroys the nest after the nestlings leave or if the eggs or nestlings are preyed upon. Sometimes they destroy the nest even before laying eggs. First nests were destroyed on predation of their contents and

TABLE 4
PLANTS, HEIGHT AND POSITION OF FIRST AND REPEAT NESTS OF A PAIR OF *G. cachinnans* AT PARSON'S VALLEY IN 1984 BREEDING SEASON

Nests	Date	Plants	Height (m)	Position
1st nest	31.12.83	*Rhododendron* sp.	2	Centre
1st repeat	5.1.84	*Eurya japonica*	3	Periphery
Later repeats	8.1.84	*Acacia dealbata*	1.5	Periphery
	31.1.84	*Asplenium* sp.	0.5	Centre
	25.2.84	*Rubus ellipticus*	1	Periphery
	13.3.84	*Acacia dealbata*	2.5	Periphery
	30.3.84	*Eurya japonica*	2	Periphery
	6.4.84	*Rhodomyrtus*	3	Periphery
	10.4.84	*Oldenlandia* sp.	1	Periphery

TABLE 5
RATE OF MATERIAL TRANSPORTATION BY TWO PAIRS OF *G. cachinnans* AT GOVERNOR'S SHOLA AND PARSON'S VALLEY

		Hours of day 0700-1800)												
	Period of Obs.	7	8	9	10	11	12	13	14	15	16	17	18	Total visits
Nest at:								No. of visits						
Govt. Shola (1-3 March, 1983)	33h	13	25	37	48	39	24	26	15	20	15	44	12	318
P. Valley (8-11 Jan. 1984)	25h	9	17	22	21	9	2	11	18	11	21			141

TABLE 6
TIME SPENT IN DAYS IN NEST BUILDING BY *G. cachinnans* (TOTAL NESTS = 24)

	No. of nests	Mean (days)	s.d.	Range
1st nests:				
Early season (Jan. & Feb.)	11	14	2.84	10-18
Late season (March & April)	8	7	1.75	5-11
Repeat nests:				
Early season (Jan. & Feb.)	3	14	2	12-16
Late season (March & Apr.)	2	6	6	5-8

before renesting, except in one instance when the birds destroyed the first one after the repeat nest had been built. Nest destruction is effected within 48 hours of abandoning the nest. Two pairs of *G. cachinnans* built a small platform with moss, *c.* 40 cm close to the original nest, which remained incomplete and was destroyed by the birds along with the original one, after the nestlings had fledged. In no case was material from the old nest transported to the repeat nest, as has been reported for jungle babbler *Turdoides striatus* by Andrews and Naik (1970). Both the birds take part in picking and throwing the nest material around and destroy the nest in three to eight visits over one to four days.

Eggs, egg-laying and incubation: Observation showed that eggs were laid between 0600 and 0800 hrs on successive days. They were pale blue, with reddish brown speckless

TABLE 7
COMPOSITION OF TWO *G. cachinnans* NESTS

Nests No.	Type of material	Weight (g)	Total Weight (g)
1 (near human habitation)	Moss	18.0	
	Leaves	4.0	
	Twigs	4.0	
	Cellophane paper, paper, plastic, cellophane, string, cloth, rope, thread, cotton	4.0	39
	Feather and Fur	1.5	
	Hair	0.2	
	Miscellaneous	7.0	
2 (away from habitation)	Moss	17.0	
	Leaves	7.5	
	Twigs and grass blades	4.5	
	Feather	0.7	38
	Miscellaneous	8.0	

Two nests of approximately the same weight were selected two show the relative variation (by weight) of nest materials in nests and away from habitation.

TABLE 8
MEASUREMENTS OF *G. cachinnans* EGGS (n=13)

Mean length (mm)	s.d.	Mean breadth (mm)	s.d.	Range (mm)
25.2	0.53	19.1	0.29	(23.8-27.1)x (18.6-19.6)

mostly concentrated at the larger end. The average dimensions of 13 eggs were 25.2 x 19.1 mm (Table 8). The clutch size was invariably two; no clutch of three eggs was observed as reported by Baker (1932). The average fresh weight was 4.9 g (n = 13, s.d. 0.22, range 4.5-5.2 g).

Both the sexes start incubating as soon as the clutch is complete, although one of the pair was found on the nest on the first day of laying. Van Tyne and Berger (1959) suggested that some species may sit on the eggs without incubating them. There was no incubation at night till the clutch was completed.

The incubation period was 16 days for 13 nests and 17 days for two nests. During the process of incubation two eggs of a clutch lost 0.8 g of weight. The fresh eggs weighed 5 g, on sixteenth day both were 4.2 g and

upon hatching on seventeenth day the nestlings weighed 3.8 and 3.5 g.

The periods of attentiveness (periods on the nest) and inattentiveness (periods off the nest) were observed from 0600 to 1800 hrs except for a lunch break for the observer taken at different times on successive days. When one of the pair relieved its mate from nest and continued incubation, it was noted as one uninterrupted attentive session. Data were collected from two nests for 95 and 161 hours over nine and sixteen days of incubation in 1983 and 1984 breeding seasons respectively. There was no significant variation in the rate of incubation in the last nine days at both the nests ($t = 0.81$, d.f. 16, $p \leq 0.05$). The birds on an average spent 68% and *c.* 70% of the total time on nest in the last nine days. The rate of incubation increased as the days progressed and reached the maximum during 2-3 days prior to hatching (Fig. 3). The average number of attentive sessions per day in 1983 and 1984 breeding seasons was 21 (range 15-27) and 20 (range 13-28) respectively.

On completing a session of incubation, one of the pair usually remained near the nest and was more attentive, raised an alarm at the approach of any intruder when the incubating bird joined in. The incubating bird otherwise did not leave the nest till the disturbance was very close. In two cases I touched the tail of the incubating birds before they left hastily. Other birds, going very close to the nest were chased away either by the incubating bird or its mate.

While on the nest the bird changed its position and turned the eggs with the bill. I heard incubating bird sometimes calling (n=6) from the nest, and also responding (n=32) to its mate's call. Gaston (1978) reported similar behaviour for common babbler *Turdoides caudatus*.

Weather had a direct effect on incubation behaviour. The birds did not leave the nest if it rained till shower was over. In the evening heavy mist, cloud and rain sometimes stimulated the birds to settle on the nest before the normal retiring time. This behaviour was also observed by Khan (1977) in the black-and- orange flycatcher in the Nilgiris.

Hatching: The eggs hatched in the sequence of laying over a total period of six hours (n=6), between 0800 and 1600 hrs. Before hatching cracks appeared on the broader end, above the center, eventually forming a hole. The parents were not seen assisting the hatching chick in coming out of the shell. Once at 1030 hrs I checked a nest in which the first egg had hatched. I found a hole at the broader end of the other egg and heard the piping of the chick. I checked the nest in the afternoon and found the condition of the egg unchanged. The parents were feeding and brooding the first chick. Next day the chick died in the egg shell.

Egg shells are disposed of a distance of 20-30 m from the nest within about 45 minutes following each hatching. The parents did not remove the infertile (unhatched) egg (n=1) which remained in the nest even after the other nestling left. This behaviour has also been observed in the redwhiskered bulbul *Pycnonotus jocosus* (pers. obs.) and black-and-orange flycatcher (Khan 1977) in the Nilgiris. In one instance the unhatched egg remained in the nest for three days. I then broke the egg and left it in the nest whereupon it was removed by the parents.

Nestlings: The young *G. cachinnans* have down at hatching on the dorsal surface of the body, forehead, nape and the dorsal

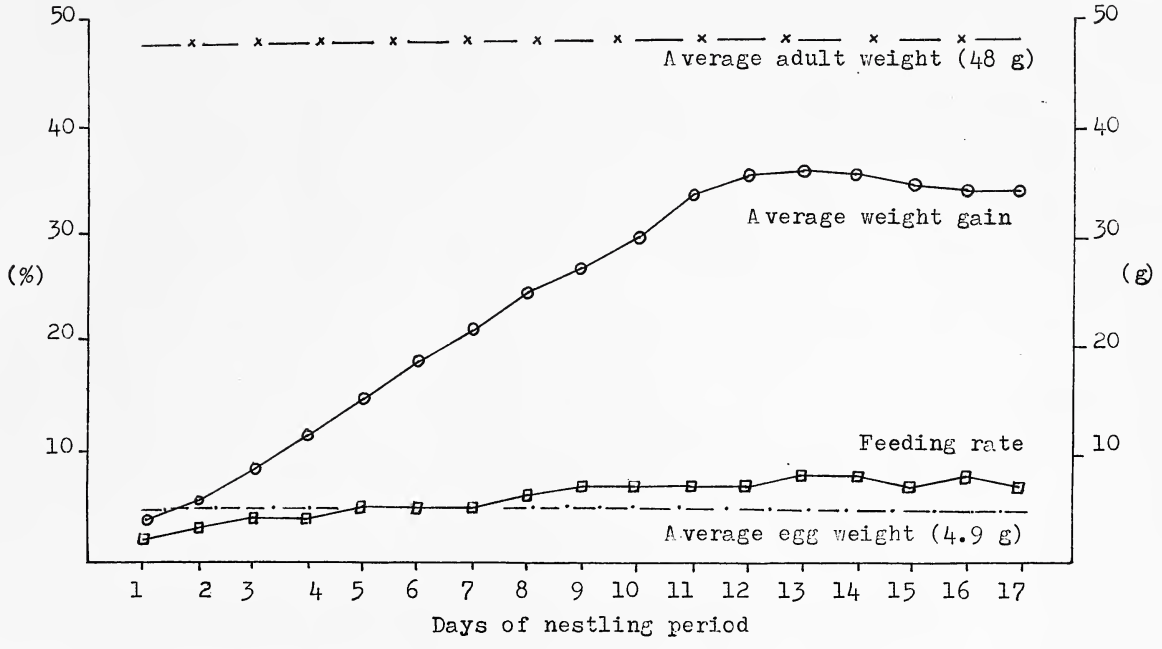

Fig.5. Rate of feeding visits by the parents and average weight gain by the nestlings at a *G. cachinnans* nest.

side of the wing bases. The body is flesh coloured and eyes are closed. The abdomen is the largest part of the body and viscera are visible through the skin. The gape is wide and yellowish in colour. In a few hours time bluish spots become distinct along the feather tracts. The average weight of eight nestlings at birth was 4 g (s.d. 0.25, range 3.5-4.3 g). They are responsive to tapping on the nest rim.

Brooding: Brooding started on the day of hatching, and continued till the seventh day of life. Both sexes shared brooding, one of the pair spent nights in the nest till the nestlings' departure. The highest brooding was recorded on the first day, 58% (Fig. 4). Young nestling passerines are not able to regulate body temperature (Pettingill 1956) after hatching and so the rate of brooding was higher in the first few days. On the seventh day there was no brooding after 1308 hrs. On the eighth day the parents brooded only for 45 minutes. The average sessions during the brooding period were 22 (range 11-34) and the mean time spent per session was 11 minutes (range 1-35 minutes).

Development of nestlings: Whenever I visited the nests the parent birds gave loud alarm calls. To avoid the danger of attracting predators morphological changes and growth were recorded for only one pair of nestlings, daily between 0800 and 1000 hrs.

There was no remarkable change for the first two days. On the third day a horizontal slit on the eye ball had widened. A prominent sheath emerged at the sternoabdominal tracts. Rectrices started growing. On the fourth day the nestlings were more responsive to vibra-

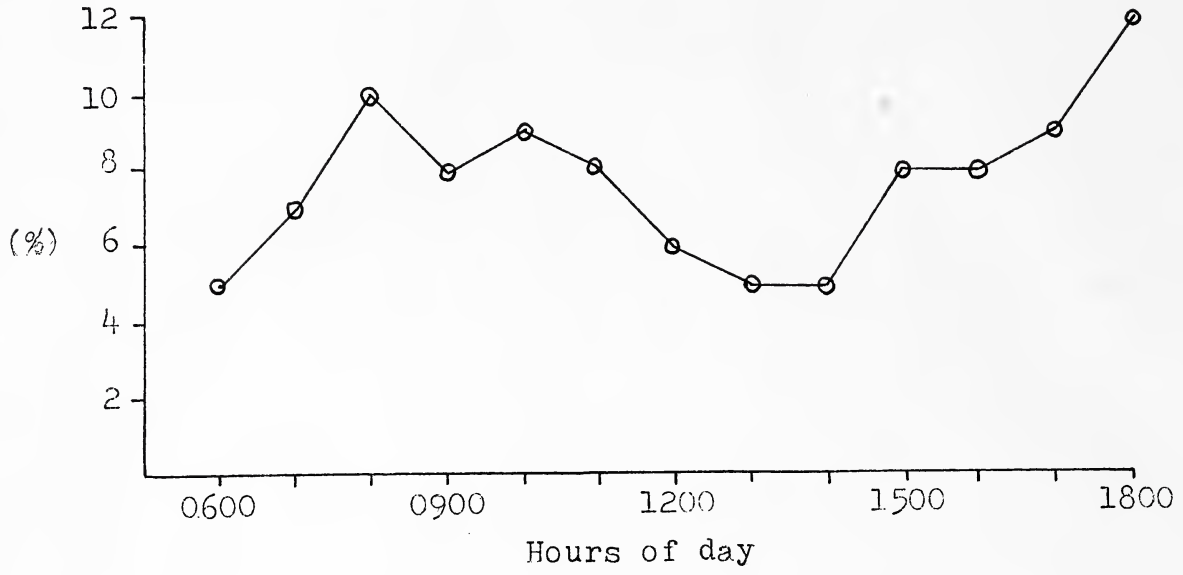

Fig. 6. Rate of visits for feeding the nestlings by the parents at a *G. cachinnans* nest at different hours of the day.

tions near the nest. All future feather tracts became conspicuous. On the sixth day the primary and secondary feathers were in pin, growing up to 10 mm and their coverts up to 4 mm. Rectrices 3 mm. On the seventh day the nestlings could open eyes partially. Bill 9 mm, wing 15 mm; primary and secondary feather calami 13 mm and 15 mm, their coverts 5 mm and 6 mm respectively. The nestlings started screaming while being weighed and the parents' alarm call was much louder. By the tenth day the nestlings could open their eyes fully. Bill and tarsus became darker and attained the average adult size of 16 mm and 30 mm respectively. They grasped the nest linings while being removed from the nest. On the fourteenth day the white eye stripe was prominent. Most of the feathers started sprouting having tufts of down at their tips. The nestlings preened and shook their bodies. On the seventeenth day the completely feathered nestlings more or less resembled the parents. Down was still attached to the tips of the feathers. Wing 20 mm, bill 16 mm, primary feathers *c.* 50 mm, secondary feathers *c.* 46 mm. The nestlings were jumping on the nest, fanning with the wings and crawling on the nest rim. On the eighteenth morning *c.* 0900 hrs both the nestlings left the nest by hopping from branch to branch. At that time the parents seemed to be agitated. They flew and hopped around restlessly close to the nestlings until the nestlings settled down in a well concealed place.

Nestling weight: The average weight of the nestlings (4.1 g) at hatching is more than two-thirds of the average weight of nestlings increased steadily from the first day to the thirteenth (Fig. 5) with average daily weight increases of 2.43 g (n=2). On the thirteenth day the average nestling weight was 35.7 g which is *c.* 75% of the average adult weight

(48.7 g, n = 6). There was a slight weight decrease of 0.3 g between the thirteenth day and the day before fledging. The feeding curve (Fig. 5) shows that there was no increase in the feeding rate from the thirteenth day of nest life.

Feeding rate: Both the parents fed the nestlings. Feeding behaviour was observed for *c.* 175 hours following the same methods as for incubation behaviour. The average number of feeding visits per hour was 4 (s.d. 1.9, range 2-7). The rate of feeding increased steadily from the first day (2%) to the thirteenth (8%). There was a fall (1%) in feeding rate on the fifteenth and sixteenth days.

There were two peaks of feeding during the day (Fig. 6), one at 0800 hrs (10%) and the other at 1800 hrs (12%). The feeding rate was high in the evenings perhaps to compensate for the non-feeding period of night. At daybreak the parents collected food for themselves as well as for the nestlings. This would explain the low feeding rate in the early morning.

The parents fed the nestlings with smaller insects for the first four days. From the fifth day onward bigger insects like caterpillars, grasshoppers and moths were brought. From the fifth to the seventeenth day caterpillars formed 40% of the total diet. *Rubus*, *Ilex* and other fruits were fed at the later stage of nestling period.

Nest sanitation: The parents swallowed all faecal sacs produced by the nestlings. While passing a faecal sac the nestlings elevated their cloacal regions, but sometimes the parents prodded to stimulate defecation. The excreta was enclosed in a whitish, oily sac. After delivering food, parents always waited for the faecal sacs, and *c.* 50% visits provide them with sacs.

Nestling period: The average nestling period was 16.5 days (n = 11, s.d. 0.87, range 15-18 days). It is reported by several workers that the nestlings of few birds leave the nest prematurely if handled during the last few days of nestling period. This did not happen with the pair of nestlings I weighed and handled regularly. But four other pairs of nestlings left while checking the nests. But I could not be sure whether they left prematurely or whether they were on the last day of their nest-life.

I had ringed two pairs of nestlings before they fledged. After leaving the nest, the fledglings remained hidden in foliage near the nests. They uttered acceptance call (*cre-re-re*) and constantly fluttered the wings while being fed by the parents. One pair remained with its parents for 21 days and the other for 29 days near the nest sites.

Loss of eggs and nestlings: Out of 62 nests, eggs from two nests were preyed upon by the crow pheasant *Centropus sinensis*. Other eggs (n = 28) and nestlings (n = 11) disappeared without trace and were probably robbed by crows *Corvus macrorhynchos* and *C. splendens* or snakes. Two eggs remained unhatched, one nestling was found dead in the nest.

Breeding success: Forty eight pairs of *G. cachinnans* were observed. Out of 106 eggs which were laid, 76 hatched and 64 nestlings fledged successfully (Table 1). The breeding success for 1983 and 1984 was 64% and 56% respectively (x-60%) and the variation was not significant ($X^2 = 0.53$, d.f. 1, $p \leq 0.05$). This figure is slightly more than Lack's (1954) average figures of 45% for passerine birds with open nests, the range 22 to 59 per cent.

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FROGS AND PADDY: PROBLEMS OF MANAGEMENT [1]

CARL GANS [2]

Key words: Frogs, reproduction, predation on, paddy production, conservation, ecological study

Frogs are claimed to enhance agricultural productivity. However, this statement, while likely true, deserves test. The difficulty is that there are multiple species and growth stages of frogs involved, and observations indicate that these species differ among regions and, more important, seem to differ with the cycle of paddy production. The stages of cultivation are briefly summarised, and the ways this seems to affect the populations of frogs are noted. Frogs appear to use paddy zones both for feeding and breeding. However, the stages of paddy production likely affect the effectiveness of predators. This paper attempts to ask some questions about possible effects and make some suggestions regarding possible studies. These may lead to maintenance of biodiversity and simultaneously establish practices that might have a desirable effect on agricultural productivity.

INTRODUCTION

Recently, there have been several conferences decrying the drastic reduction of frog populations, indeed of number of frog species (Anonymous 1990, Blaustein and Wake 1990; also see Froglog Publications of the Declining Amphibian Populations Task Force. IUCN/SSC, Corvilia, OR. U.S.A.). India was mentioned prominently in a number of associated news releases, perhaps because the Government had some time earlier made the export of frog legs illegal. The cost, in terms of lost revenue, had been justified on the grounds that the animals were useful in pest control and that their harvest involved much cruelty. However, in global terms each national ban has seen increased trade elsewhere to meet market demands.

There is little question that harvesting of wild animals for skins, food and sport often involves some cruelty; yet this may be resolvable by the development of humane methods of killing. However, the claim that frogs facilitate pest control is less clear cut, involving evaluation of the problems of overexploitation by developing sustainable management.

Discussion with the few specialists on Indian amphibians and a review of the literature reveals remarkably little solid evidence regarding the species of frogs involved and their effects on agricultural production. This raises questions whether the present action is indeed useful, and perhaps as important, whether it is sufficient for protecting the frogs and aiding the farmers. This issue may well require further study and experimentation.

It is here proposed to ignore for the moment the frogs of the Indian mountains, bogs and rainforests, as these represent small often endemic groupings that need protection, but likely could only be saved by protecting their environment. In contrast, most of the country is used for agriculture and most of the temporary wetlands are in paddy, devoted to the production of rice and similar cereals. Their frogs are here used as an example, commenting on some

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issues observed during survey collecting in India and Sri Lanka. The frogs associated with other kinds of agriculture, those of coconut palms, of tea, coffee and cardamom plantations, pose different questions and potentially involve different protective schemes.

Which frog is it?

It seems of considerable interest to consider the way that cultivation impacts on the biology of the frogs that now occupy paddy regions. However, before the life history of these animals can be discussed, it is necessary to know the species involved, where these occur and how widely they range. This is particularly important for a region such as India which seems to have far ranging lowlands, utilized for agriculture involving various kinds of intermittent flooding.

Past reports have referred to species, such as *Rana cyanophlictis*, *R. hexadactyla*, and *R. tigerina*, as ranging from the extreme south of the Peninsula to the foothills of the Himalayas. However, such statements have rarely been confirmed by a single researcher who examined samples from all parts of the range by modern techniques or better yet, travelled from one region to another in each comparing the "common" forms. Instead, local investigators have examined local frogs, and compared them to reference accounts in the inadequate faunistic handbooks; however, these allow discrimination only of the obviously different. Modern analyses of the frog faunas of Europe and North America have shown that the widespread "common" species often involve replacement by very similar, but discrete species. It is likely that the same situation will apply to India as well.

For instance, the American spotted grass frog used to be referred to as *Rana pipiens* and assumed to represent a single species ranging from Canada to Mexico. Unfortunately, recent examination has shown that the population includes more than four distinct species differing in mating call, morphology, and color and, of course, in several biochemical characteristics. The effect of these frogs on the local insects clearly differs. The situation in Europe is even more complex, the common frogs involving hybrid swarms. Consequently, it is necessary to apply call and biochemical, as well as morphometric techniques for an assay of the distribution of the seemingly wide-ranging Indian species.

The study of frogs normally proceeds by two major techniques. The first is to catch a series of each kind of frogs observed and to preserving it for later careful study in a museum setting. One may then establish differences in color, shape, size, and see how these differ among geographical regions. During the process of collecting one must also search for juveniles and females (which often differ in color and proportions). As these do not advertise their presence, they tend to be more difficult to take; obviously, they are as important to an understanding to the fauna. Collection should proceed nocturnally as the frogs are then most active. The collecting effort should be amplified by a diurnal search, concentrating on tadpoles in the water, and looking for adults in hiding places that they occupy during the day between calling intervals. Many frogs hide underground during the dry season and become active during the monsoons; this has to be taken into account in establishing an adequate faunal sample.

A better approach to sampling utilizes the mating patterns of frogs. Commonly, their males travel to various bodies of water and

call from these. Other males move toward sites from which calls originate and join the chorus which may ultimately reflect the size of the body of water. Females are attracted by the calls and at some moment approach the males; mating occurs thereafter. Some males start to call away from the water and only reach ponds or streams very briefly at the peak of arousal, with the females there meeting them.

The call of each species of frog in a given area will be unique; this allows the females to approach the conspecific males. This also lets the collector assay quickly which species are "available" at a given site. It is relatively easy to determine the number of calls and then to enter the area and locate and identify unequivocally the specimen generating each sound. A small tape recorder permits one to obtain a record of local calls; the records may later be compared electronically to establish their characteristics and possible local variation. As frogs will also differ in the site from which they call, one mainly needs a good ear to make the assay.

These techniques allow an initial survey which naturally provides mainly a preliminary overview. This needs to be followed by two steps. The first should establish the range of widely distributed species by checking whether their morphology (color patterns, morphometrics, gland patterns, etc.) is constant or shows discontinuities. Tape records of frog calls can be compared similarly to search for discontinuities. Immunological and molecular studies should then sample any populations that differ from adjacent ones, but should also determine whether widely-ranging are homogeneous by these criteria as well. The second step consists of what might be called local studies, that deal with the details of the natural history of each species.

Paddy production

The way rice or paddy is produced likely has major implications for the biology of the frogs. The process of growing rice requires that the fields will be flooded regularly. The image of women, wading in water while they plant the rice, is a common sight. However, rice fields are hardly a constant wetland; for much of the time, they are dry. Consequently, we know that frogs enter the paddies and that they call and presumably breed there, but we know little of what happens next.

Paddy production starts with the monsoon, although irrigation could generate equivalent effects. The fields are subdivided by narrow dams, rising some 30 cm above them (on flat areas, in hilly zones the downhill dams may be much higher). After the harvest an interim grassy vegetation forms. This is often grazed. The process starts with a flooding of the fields, either due to the retention of the rain waters, or by channelling in irrigation water. During this initial flooding stage of production the vegetation becomes soaked, but the amount of irrigation water tends not to cover the tops of the vegetation.

The second, first-plowing stage is that of breaking the soil, often by buffalo-pulled plough. The mat of grasses and herbs is lifted up and divided by the plough. Sinking down, the divots rest on one another and the intermittent zones become flooded channels. Often the footprints of the buffalo provide a series of intermediate holes that fill with water.

The third stage is sometimes referred to as mudding. Buffaloes are caused to walk back and forth, dragging various implements that break up the root mass and turn the substrate into a muddy soup. Mudding proceeds initially for a small portion of the acreage

and here a dense bed of seedlings is grown from seed. As the emerging leaves reach a height of perhaps 20 cm, the rice plants and their roots are pulled out and bundled.

The fourth stage is planting. The small bunches of seedlings are now replanted in a more open spacing (perhaps 5 to 10 cm apart) in which they can continue to grow. During the planting – growing phase, the surface continues to be flooded.

After some time, the plants mature. The water supply then is diverted from the fields, which are allowed to dry. The rice is cut and threshed, often on the same fields on which it was grown. Sometimes, the husk is burned here, although the straw commonly serves other purposes.

The land then is permitted to remain fallow for some time, allowing grasses and annuals to grow until the following season. Obviously, there are local variants in the production pattern, depending on the region, the amount of fertilizer applied, the use of the intercrop vegetation as part of the nitrogen enrichment scheme and similar factors. Also these are parallel differences in the nature of the ditches that provide water during the start of the growing season, the distance over which the water is diverted and the proximity to permanent bodies of water.

Primary observations

Observation of the kinds of frogs observed in association with paddies indicate that the frogs seem to have local options, but also that they exhibit certain general trends. Patchiness seems to be the key to understanding the kinds of frogs found, and this reflects the nature of the areas adjacent to the particular field. Its distance from the edge of the overall region planted in rice affects the species composition. This is also affected by the kinds of vegetation occurring adjacent to the planted region; forest, tree garden, coconut palm, plantain, tea or human housing each have effects on the composition. The composition is also affected by other microecological factors, such as the recent history of the agricultural work, activity in adjacent patches and the state of the weather. However, the initial observations need to be tested and evaluated statistically.

The most important result of the initial observations has been the observation that the community of frogs observed in a paddy area commonly involves from six to a dozen species, with only one to three of these actually being "large" frogs. However, prereproductive juveniles of the very large (<100 mm snout-vent length) species (*Rana hexadactyla* and *R. tigerina*) also contribute to the population in each paddy. Rarely does one observe (collect) as many females as males; this does not appear to reflect only the silence of the latter, but suggests that the females often enter the flooded paddy later. There is a strong "edge effect" with distinct populations occurring adjacent to other paddy fields than adjacent to zones with other agriculture or fallow zones. Commonly, one finds that calling males of particular species clump within particular paddies; thus, one wades through subzones in which one or another call pattern predominates.

The number and kinds of frogs observed change drastically with agricultural phase. This is very clear in areas in which the individual paddies are at a different stage of cultivation. Each frog species found in a particular patch then reflects local circumstances much more than those of the overall region. The amount of vegetation, particularly of that

rising above the surface and the size and permanence of mud islands and of intermediate flooded regions appear most significant.

Large frogs were generally observed in the paddy only during the first cultivation stage. Their adults sit and call close to the edges of the unplowed fields with more specimens seen where the fields are adjacent to stone walls and tree covered edges. Juveniles of these species seem to range further into the open fields. Only some of the smaller species co-occur with these forms. Only after the first plowing do the diversity of calls reach a maximum, by this time the water surface tends to be subdivided and the paddy represents a series of independent pools and channels separated by strips of soil and vegetation.

With the exception of one or two species of ranids, including the skittering frogs, most species of smaller frogs inhabit and call adjacent to patches of vegetation and soil. Their calling sites are microecologically distinct. Common specific calling sites are small patches of open soil, open water, bits of grass, paddy bunds (from which some forms call projecting out over the water, whereas others find, or build, cavities *into* which to call), and small (diameter <10 cm) pools with the animal floating in the center or standing along the edge (calling upward). Many species seem to produce ventrilocal effects, as if the call is reflected or misdirected.

As the phases of cultivation change the microecology of the paddy surface, one can see a basis for the shift in frog usage pattern. However, more is involved than simple replacement, as the apparent density of particular species seemingly rises and falls. Many individuals of the species that characterize the later stages are either absent or silent during the earlier ones.

Where do all the frogs go?

It is likely that much of the observed pattern reflects predation. The described patterns of agricultural practice expose more and more individuals to observation and attack. The sheltering vegetation becomes reduced and may disappear during mudding. Separate predation patterns occur during the day and night.

During the day, one observes many species of wading birds, including herons and egrets, some of which will follow the plow, as they travel on or walk with buffalo traversing marshy areas. As frogs jump from the feet or the plow, they are detected and caught. At night, there may well be a pattern of bat predation, as some of these detect moving frogs. This again suggests the importance of the cultivation stage to frogs survival; it would be much easier for a bat to detect a frog in an open area than amid partly flooded vegetation. I am informed that there are no sound-hunting bats in southern India (Neuweiler 1990). This leaves open the reason for the ventriloquists; what other predator may be listening to these frogs?

The probability that bats are significant nocturnal predators of frogs is supported by two incidental observations. First, during nocturnal travel by car, one commonly sees bats cruising very low, within 30 cm of the road surface. This seems unusually low for catching flying insects. Also, most of the frogs seen crossing the roads, appear to traverse open areas with a series of jumps and then crouch down resting close to the vegetated berm, rather than moving one jump at a time and sitting up in the middle of the road.

Missing information?

The preliminary observations indicate

that the paddy populations are comprised of multiple species of frogs and that the species composition changes with the pattern of cultivation. However, these observations leave open many questions, some of which require further observation and other experiments. The two key questions that need resolution are: How important are the individual frogs we see to the survival of their species? and how important are these frogs to the ecological balance of the field and to pest control? We really have only minimal data on the first and no data on the second set of questions.

To answer the first question, we need information on when the females reach the males and where and when the eggs are deposited. Next we need to know what happens to the tadpoles during the phases of paddy production; are these species maintained by the reproduction we see in the paddies or is most of the next generation produced in adjacent areas. When do the young metamorphose, does this happen in the flooded paddy area or in adjacent zones and where do the small frogs go thereafter? How long do the metamorphosed frogs stay near the paddies, and where do they pass the dry season? What is the survivorship of each of these frog species, i.e. how many eggs are laid (per clutch, per season), how many tadpoles metamorphose into frogs, and how many frogs. Do aspects of the cultivation practice, for instance, the gradual desiccation of the paddy affect the time of metamorphosis, as it does in some American frogs? These questions require detailed observation of the animals and of their offspring throughout the year. Also, it may be necessary to keep some areas enclosed or fenced in order to study the effect of predation. Various simple experiments should begin allow one to provide and test answers to such questions about the natural history of the species.

To answer the second set of questions, we need information on how many frogs there are for each species and what might be their mass per hectare. Next one needs to know who eats what, when and where. Which of the frogs indeed feed in the paddy areas, at what age and size stage, what are their prey items and what is the mass of prey consumed? Do any of the large frogs eat small frogs? Do they deter predators on the smaller species? Some answers may be obtained by examining the stomach contents of captured frogs. Obviously such examination must occur very quickly after capture. For small frogs, the animals must be preserved immediately (so that digestion is then arrested); for larger frogs one should be able to experiment with stomach flushes, some tests being necessary to assure that no prey will be retained in the stomach.

Once the prey has been identified one needs to determine whether the species of molluscs, annelids and arthropods involved have any direct or indirect bearing on crop productivity. For that matter one may also ask whether they represent vectors for diseases of man or domestic animals. On the other hand it becomes necessary to consider the effect of the chemicals often applied, those used as fertilizers, insecticides, vermicides and fungicides. What is their influence on insect populations and, important in the present context, on the eggs, larvae and adults of the frogs. Do the populations of frogs show any developmental abnormalities (teratologies), the frequency of such deformations, whether affecting limb arrangement or color pattern, often indicates the level of toxic materials in the environment.

A General Overview

The main difficulty with the general approach to the protection of Indian frogs (and for probably other species as well) is that we assume, but we do not know. The prohibition of the export of frog legs resulted in some loss of foreign exchange; however, the documented benefits derive mainly from humanistic considerations. The issue of "pest control" deserves much further study. For very few areas have there been longitudinal (long-term) baseline studies, giving documented quantitative observations, repeated year after year. It "seems" that there are "lots" of frogs and that these may have an effect on paddy production, but is this true? How many frogs and of which species were there a decade ago, five years ago, at the time the export ban was imposed, or now? Which species are most useful and are these the ones that are being protected? What additional resources should be invested, perhaps in maintaining permanent water zones, near paddy fields. Surveys should be carried out using standardized methods (Heyer *et al.* 1993).

We need observations to answer such questions, but we also need ecological experiments. What is the effect of frog removal on conspecifics or other species? What would be the effect of predator exclusion (assuming that we are correct about which predators are significant? How important are undisturbed waters near paddy areas, whether as ponds or as canals? Are terrestrial shelter zones important and if so are holes and tunnels significant? Folklore suggests that the tunnels of the dams dug by rats and crabs are entirely deleterious; might they have a different kind of merit, perhaps in providing shelter for the larger species of frogs?

The several kinds of rice represent a key component of human diet. Their cultivation involves a relatively enormous area. Frogs are certainly an obvious and substantial aspect of the rice field flooding and planting cycle and estimates suggest that their biomass is a substantial portion of the overall amount. Theoretically they should affect the yield in several ways. Yet we do not yet know how many species of frogs there are in different regions and even less how they survive and what effect they have on our well being.

The need to know more about this potentially critical system demands that more teachers and scientists actually proceed to join the villagers in the paddy fields. It also requires that artificial barriers to carrying out such studies be removed, indeed that the agencies charged with protecting Indian wildlife actively foster both local and central studies in many regions.

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FISH FAUNA OF TRIPURA, NORTH-EAST INDIA[1]

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Key words: Tripura, fish fauna, biogeography

The present paper deals with a synopsis of 129 fish species under 78 genera, 33 families and 11 orders from the rivers of Tripura giving their scientific names along with local and English names. Biogeography of these fishes are also discussed.

Tripura is a hilly state lying in the sub-Himalayan zone; its various physiographical nature has contributed to the formation of a diverse fish fauna. A perusal of the existing literature on the fish fauna of Tripura shows that there has not been a comprehensive survey of the fish fauna potential and there is no consolidated account of the fishes of the state. This region deserves an extensive fish faunal survey to assess species new to the state and even new to science. An attempt has, therefore, been made to conduct at a thorough survey of the fish faunal resources and to prepare a consolidated account of the fish fauna of Tripura. Three field surveys (1985, 1989 and 1990) covered almost all the important fish landing centres of the state. In the preparation of the present list of fishes, I have also included all the fishes recorded by earlier workers in addition to my own collections. The fishes collected belong to 129 species under 78 genera, 32 families and 11 orders, and comprise both riverine and torrential stream forms, along with some freshwater-visiting marine fishes or, in other words, migratory species. The list of fishes is given in Table 1 with scientific name, as well as local and English names.

DISCUSSION AND BIOGEOGRAPHY

This study is an attempt to provide a consolidated account of all the fishes so far known from Tripura. This account includes the fishes collected by me and the fishes recorded by earlier workers, namely Nair (1977), Datta (1977), Lipton (1983-84), Bhattacharya (1988) and Barman (1988, 1989, 1990, 1991, 1992). The rivers of Tripura flow to the river Meghna in Bangladesh and the topographical condition and hydrology hardly allow any riverine fishery within Tripura. It is interesting to note that most of the fishes of Tripura are common to both the Indo-Gangetic drainage and south-east Asian fishes. The occurrence of these fishes in the sub-Himalayan region of Tripura is of special significance in the geography of fishes of the North-Eastern India and that of the Indo-Malayan Archipelago. The presence of some of the marine and estuarine fishes such as *Pisodonophis boro*, *Hilsa ilisha* and *Nematolosa nasus* etc. in the rivers of Tripura may be explained that these fishes may have migrated from the Bay of Bengal through the River Gumti which falls into the River Meghna (in Comilla district of Bangladesh) which in turn falls into the Bay of Bengal. Besides this River Gumti, the largest river of Tripura, the state has two tidal rivers, namely, the Fenny and the Muhuri, through these two tidal rivers migration of some marine fishes might be possible. The detailed systematic studies of 129 fish species under 33 families and 11 orders have already been completed and will be incorporated in the State Fauna of Tripura.

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TABLE 1

Scientific names	Local names	English names
Family: ANGUILLIDAE		
1. *Anguilla bengalensis bengalensis* (Gray & Hardwicke)	Eel	Long-finned eel
Family: OPHICHTHIDAE		
2. *Pisodonophis boro* (Hamilton-Buchanan)	Ghaoura	Low-finned eel
Family: CLUPEIDAE		
3. *Hilsa ilisha* (Hamilton-Buchanan)	Ilish	Indian shad, Hilsa shad
4. *Gudusia chapra* (Hamilton-Buchanan)	Khoira, Chapila	Ganges shad
5. *Nematolosa nasus* (Bloch)	Nil	Bloch's gizzard shad
Family: NOTOPTERIDAE		
6. *Notopterus chitala* (Hamilton-Buchanan)	Chital	Humped feather fish
7. *Notopterus notopterus* (Pallas)	Phouli	Feather back fish
Family: CYPRINIDAE		
8. *Chela (Chela) cachius* (Hamilton-Buchanan)	Chapkhowari, Kachhi	Chela
9. *Chela (Chela) laubuca* (Hamilton-Buchanan)	Chapkhowari, Dankena, Layubuka	Winged rasbora
10. *Salmostoma bacaila* (Hamilton-Buchanan)	Chela, Jellahri	Chela
11. *Salmostoma clupeoides* (Bloch)	Selkona	Chela
12. *Hypophthalmichthys molitrix* (Valenciennes)	Silver carp	Silver carp
13. *Esomus danricus* (Hamilton-Buchanan)	Darkina	Flying barb
14. *Danio aequipinnatus* (McClelland)	Ghila	Giant danio
15. *Danio dangila* (Hamilton-Buchanan)	Naptamach	Danio

TABLE 1 (Contd.)

	Scientific names	Local names	English names
16.	*Danio devario* (Hamilton-Buchanan)	Bashpata	Danio
17.	*Danio rerio* (Hamilton-Buchanan)	Anju	Zebra fish
18.	*Rasbora daniconius daniconius* (Hamilton-Buchanan)	Darkina	Common rasbora
19.	*Rasbora elanga* (Hamilton-Buchanan)	Elang	Rasbora
20.	*Aspidoparia jaya* (Hamilton-Buchanan)	Chola, Barila	Aspidoparia
21.	*Aspidoparia morar* (Hamilton-Buchanan)	Morari, Morar	Aspidoparia
22.	*Amblypharyngodon mola* (Hamilton-Buchanan)	Maka	Mola, Indian carplet
23.	*Barilius barila* (Hamilton-Buchanan)	Gilland, Caedra	Hill trout
24.	*Barilius barna* (Hamilton-Buchanan)	Bhola, Ghol	Hill trout
25.	*Barilius bendelisis* (Hamilton-Buchanan)	Khoksa, Joia	Hill trout
26.	*Barilius gatensis* (Valenciennes)	Nil	River carp
27.	*Barilius nelsoni* Barman	Nil	Hill trout
28.	*Barilius shacra* (Hamilton-Buchanan)	Koksha	Hill trout
29.	*Barilius tileo* (Hamilton-Buchanan)	Nil	Hill trout
30.	*Raimas bola* (Hamilton-Buchanan)	Bola, Bhola, Goha	Hill trout, Indian trout
31.	*Cyprinus carpio carpio* Linnaeus	Carpio	Common carp
32.	*Semiplotus semiplotus* (McClelland)	Badangi	King fish

TABLE 1 (Contd.)

	Scientific names	Local names	English names
33.	*Punitus chola* (Hamilton-Buchanan)	Tit puti	Green barb
34.	*Puntius clavatus clavatus* (McClelland)	Puti	Nil
35.	*Puntius conchonius* (Hamilton-Buchanan)	Kanchan puti	Stigma barb
36.	*Puntius gelius* (Hamilton-Buchanan)	Puti	Nil
37.	*Puntius sarana sarana* (Hamilton-Buchanan)	Swarna puti	Olive carp
38.	*Puntius sophore* (Hamilton-Buchanan)	Sar puti	Stigma barb
39.	*Puntius ticto ticto* (Hamilton-Buchanan)	Tit puti	Fire fin barb
40.	*Osteobrama cotio cotio* (Hamilton-Buchanan)	Gila khani	Cotio
41.	*Schismatorhynchus (Nukta) nukta* (Sykes)	Nil	King fish
42.	*Labeo bata* (Hamilton-Buchanan)	Bhangna	Bata
43.	*Labeo boga* (Hamilton-Buchanan)	Bangum bata	Burmese fish, Jamuna fish
44.	*Labeo calbasu* (Hamilton-Buchanan)	Kalbasu	Calbasu, Orange fin labeo
45.	*Labeo gonius* (Hamilton-Buchanan)	Gonya	Nil
46.	*Labeo nandina* (Hamilton-Buchanan)	Nandin	Nil
47.	*Labeo pangusia* (Hamilton-Buchanan)	Loannee, Utti	Nil
48.	*Labeo rohita* (Hamilton-Buchanan)	Rui, Rohu	Rohu
49.	*Chagunius chagunio* (Hamilton-Buchanan)	Puti	Nil

TABLE 1 (Contd.)

	Scientific names	Local names	English names
50.	*Tor putitora* (Hamilton-Buchanan)	Mahasol	Mahaseer
51.	*Tor tor* (Hamilton-Buchanan)	Mahasol	Tor Mahaseer
52.	*Cirrhinus mrigala* (Hamilton-Buchanan)	Mrigala, Mrigal	Mrigal
53.	*Cirrhinus reba* (Hamilton-Buchanan)	Batta	Reba
54.	*Catla catla* (Hamilton-Buchanan)	Catla	Catla
55.	*Ctenopharyngodon idella* (Valenciennes)	Grass carp	Grass carp
56.	*Crossocheilus latius latius* (Hamilton-Buchanan)	Kalla batta	Latia
57.	*Garra gotyla gotyla* (Gray)	Ghor poia	Stone sucker
Family: PSILORHYNCHIDAE			
58.	*Psilorhynchus balitora* (Hamilton-Buchanan)	Nil	Nil
59.	*Psilorhynchus sucatio* (Hamilton-Buchanan)	Nil	Nil
Family: BALITORIDAE			
60.	*Noemacheilus botia* (Hamilton-Buchanan)	Ranimach	Striped Loach
61.	*Noemacheilus scaturigina* (McClelland)	Ranimach	Loach
62.	*Noemacheilus spilopterus* (Valenciennes)	Ranimach	Loach
Family: COBITIDAE			
63.	*Botia dario* (Hamilton-Buchanan)	Ranimach	Loach
64.	*Botia rostrata* Günther	Ranimach	Loach
65.	*Somileptes gongota* (Hamilton-Buchanan)	Ghor poia	Nil
66.	*Lepidocephalus* (*Lepidocephalichthys*) *annandalei* Chaudhuri	Gunte, Gutum	Loach

TABLE 1 (Contd.)

Scientific names	Local names	English names
67. *Lepidocephalus (Lepidocephalichthys) berdmorei* (Blyth)	Gunte, Gutum	Loach
68. *Lepidocephalus (Lepidocephalichthys) guntea* (Hamilton-Buchanan)	Gunte, Gutum	Loach
Family: BAGRIDAE		
69. *Rita rita* (Hamilton-Buchanan)	Reta	Rita
70. *Batasio batasio* (Hamilton-Buchanan)	Batasio	Batasio
71. *Mystus bleekeri* (Day)	Tengra	Nil
72. *Mystus cavasius* (Hamilton-Buchanan)	Tengra	Dwarf cat fish
73. *Mystus vittatus* (Bloch)	Tengra	Striped dwarf cat fish
74. *Aorichthys aor* (Hamilton-Buchanan)	Aor	Long whiskered cat fish
75. *Aorichthys seenghala* (Sykes)	Aor	Giant river cat fish
Family: SILURIDAE		
76. *Ompok bimaculatus* (Bloch)	Pabda	Butter cat-fish
77. *Ompok pabda* (Hamilton-Buchanan)	Pabda	Butter cat-fish
78. *Wallago attu* (Schneider)	Boal	Freshwater shark
Family: SCHILBEIDAE		
79. *Ailia coila* (Hamilton-Buchanan)	Kadali	Ailia
80. *Pseudeutropius atherinoides* (Bloch)	Patasi, Doya	Nil
81. *Clupisoma garua* (Hamilton-Buchanan)	Gaoura	Gaura
82. *Clupisoma montana* Hora	Goura	Garua

TABLE 1 (Contd.)

	Scientific names	Local names	English names
83.	*Eutropiichthys murius* (Hamilton-Buchanan)	Muribacha	Vacha
84.	*Eutropiichthys vacha* (Hamilton-Buchanan)	Bacha	Vacha
85.	*Silonia silondia* (Hamilton-Buchanan)	Shilong, Silon	Nil
86.	*Pangasius pangasius* (Hamilton-Buchanan)	Pangash	Pangash
Family: AMBLYCIPITIDAE			
87.	*Amblyceps mangois* (Hamilton-Buchanan)	Nil	Nil
Family: SISORIDAE			
88.	*Bagarius bagarius* (Hamilton-Buchanan)	Bhagmach	Bagarius, Goonch
89.	*Gagata cenia* (Hamilton-Buchanan)	Jungla	Gagata, Dwarf blotched cat fish
90.	*Nangra viridescens* (Hamilton-Buchanan)	Nil	Nil
91.	*Erethistoides montana montana* Hora	Nil	Nil
92.	*Hara hara* (Hamilton-Buchanan)	Gagot	Nil
93.	*Laguvia ribeiroi ribeiroi* Hora	Nil	Nil
94.	*Glyptothorax cavia* (Hamilton-Buchanan)	Nil	Nil
95.	*Glyptothorax conirostrae conirostrae* (Steindachner)	Nil	Nil
96.	*Glyptothorax telchitta telchitta* (Hamilton-Buchanan)	Nil	Nil
Family: CLARIIDAE			
97.	*Clarias batrachus* (Linnaeus)	Magur	Air breathing cat fish
Family: HETEROPNEUSTIDAE			
98.	*Heteropneustes fossilis* (Bloch)	Shing	Stinging cat fish

TABLE 1 (Contd.)

	Scientific names	Local names	English names
Family: CHACIDAE			
99.	*Chaca chaca* (Hamilton-Buchanan)	Kutkutya	Chaca
Family: OLYRIDAE			
100.	*Olyra kempi* Chaudhuri	Bhotsinghi	Nil
101.	*Olyra longicaudata* McClelland	Bhotsinghi	Nil
Family: BELONIDAE			
102.	*Strongylura strongylura* (van Hasselt)	Kakhya, Kankle	Freshwater garfish
103.	*Xenentodon cancila* (Hamilton-Buchanan)	Kakhya, Kankle	Freshwater garfish
Family: CYPRINODONTIDAE			
104.	*Alocheilus panchax* (Hamilton-Buchanan)	Techokko	Lesser top minnow, Panchax minnow,
Family: CHANNIDAE			
105.	*Channa barca* (Hamilton-Buchanan)	Chenga, Bora-cheng	Nil
106.	*Channa marulius* (Hamilton-Buchanan)	Gajal	Giant snakehead murrel
107.	*Channa orientalis* Schneider	Cheng	Brown snakehead fish
108.	*Channa punctatus* (Bloch)	Taki, Lata	Green snakehead fish
109.	*Channa striatus* (Bloch)	Shol, Chena	Striped snakehead fish
Family: SYNBRANCHIDAE			
110.	*Monopterus cuchia* (Hamilton-Buchanan)	Kuchia	Freshwater eel, Cuchia
Family: CHANDIDAE			
111.	*Chanda baculis* Hamilton-Buchanan	Chanda	Glassy perchlet
112.	*Chanda nama* Hamilton-Buchanan	Chanda	Glassy perchlet
113.	*Chanda raga* Hamilton-Buchanan	Chanda	Indian glass fish

TABLE 1 (Contd.)

	Scientific names	Local names	English names
Family: SCIAENIDAE			
114.	*Johnius coitor* (Hamilton-Buchanan)	Bola Bhetki	Croaker fish
Family: NANDIDAE			
115.	*Badis badis* Hamilton-Buchanan	Bot-koi	Badis
116.	*Nandus nandus* (Hamilton-Buchanan)	Nadosh	Nandus
Family: CICHLIDAE			
117.	*Oreochromis mossambica* (Peters)	Tilapia	Tilapia
Family: MUGILIDAE			
118.	*Sicamugil cascasia* (Hamilton-Buchanan)	Nadis bata, Parshey	Yellow tail mullet
119.	*Rhinomugil corsula* (Hamilton-Buchanan)	Nadir bata	Corsula mullet
Family: GOBIIDAE			
120.	*Glossogobius giuris* (Hamilton-Buchanan)	Belay or Bhalia	Bar-eyed goby
121.	*Apocryptes bato* (Hamilton-Buchanan)	Cheng	Nil
Family: ANABANTIDAE			
122.	*Anabas testudineus* (Bloch)	Koi	Climbing perch
Family: BELONTIDAE			
123.	*Colisa fasciata* (Schneider)	Khalisha	Banded colisa
124.	*Colisa sota* (Hamilton-Buchanan)	Chuna Khalisha	Nil
Family: OSPHRONEMIDAE			
125.	*Osphronemus goramy* Lacépède	Nil	Gouramy
Family: MASTACEMBELIDAE			
126.	*Macrognathus aculeatus* (Bloch)	Goichi	Lesser spiny eel
127.	*Mastacembelus armatus* Lacépèd	Baim	Spiny eel

TABLE 1 (Contd.)

	Scientific names	Local names	English names
128.	*Mastacembelus pancalus* (Hamilton-Buchanan)	Baim	Spiny eel
Family: TETRAODONTIDAE			
129.	*Tetraodon cutcutia* (Hamilton-Buchanan)	Tepa, Gangatape	Ocellated bow fish

ACKNOWLEDGEMENTS

I thank Dr M.S. Jairajpuri, Director; Dr. A.K. Ghosh, Joint Director and Mr T K Sen, Scientist "SD" of the Zoological Survey of India, Calcutta for facilities and encouragement.

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FIRST RECORD OF ALLANTINAE (TENTHREDINIDAE : HYMENOPTERA) FROM INDIA[1]

MALKIAT S. SAINI AND JAGDEEP S. DEEP[2]

Key words: First record, allantinae, tenthredinidae, hymenoptera

Nine genera represented by 9 species are newly recorded and 7 species of already recorded genera are added to the list of Indian Allantinae. Synonymy (if any), distribution, population variation (wherever significant) and some remarks have been provided for each of the enlisted species. Representative specimens of first record species will be deposited in the National Pusa Collection, IARI, New Delhi.

INTRODUCTION

To date, only 16 genera of Allantinae represented by 37 species are known from India. In the present work, 9 genera represented by 9 species and 7 species of already recorded genera have been added.

Abeleses birmanus Malaise, 1961

Abeleses birmanus Malaise, 1961. Ent. Tidskr. Arg. 82. H.3- 4, p. 232.

Specimens examined: Himachal Pradesh: Dalhousie, Kalatop — 2380 m, 29.6.1986.

Distribution: Burma; INDIA: Himachal Pradesh.

Hennedyella Forsius, 1935

Hennedyella Forsius, 1935. Notul. ent. Helsingf. 15. p. 57-59.

Distribution: Burma; INDIA: Jammu and Kashmir.

Hennedyella athaloides Forsius, 1935

Hennedyella athaloides Forsius, 1935. Notul. ent. Helsingf. 15. p. 57-59.

Specimens examined: Jammu and Kashmir: Pahalgam 2700 m, 1 female, 15.6.1986.

Distribution: Burma; INDIA: Jammu and Kashmir.

Ocla Malaise, 1957

Ocla Malaise, 1957. Ent. Tidskr. Arg. 78. H.1, p. 13.

Distribution: Burma; INDIA: West Bengal.

Ocla glabrifrons Malaise, 1961

Ocla glabrifrons Malaise, 1961. Ent. Tidskr. Arg. 82, Hafte 3-4, p. 243.

Specimens examined: West Bengal: Darjeeling — 2600 m, 1 male, 11.9.1988.

Distribution: Burma; INDIA: West Bengal.

Ungulia fasciativentris Malaise, 1961

Ungulia fasciativentris Malaise, 1961. Ent. Tidskr. Arg. 82. H.3-4, p. 244.

Specimens examined: Arunachal Pradesh: Bomdila — 2800 m, 8 females, 8 males, 1.6-3.6.1989. Meghalaya: Mawphlang — 1500 m, 1 male, 6.5.1984. West Bengal: Darjeeling — 2800 m, 8 females, 6 males; Manibhanjang — 2200 m, 3 males, 6.5.1983.

Distribution: Burma; INDIA: Arunachal

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Pradesh, Meghalaya, West Bengal. Population Variation: in some specimens terga 2-4 only are pale fulvous instead of terga 2-5, i.e. terga 5 is black in some specimens.

Formosempria Takeuchi, 1929

Formosempria Takeuchi, 1929. Trans. Nat. Hist. Soc. Formosa xix, 100, p. 85.

Distribution: Burma; INDIA: Himachal Pradesh.

Formosempria shanensis Malaise, 1961

Formosempria shanensis Malaise, 1961. Ent. Tidskr. Arg. 82. H.3-4, p. 249.

Specimens examined: Himachal Pradesh: Dalhousie, Kalatop — 2380 m, 5 males, 29.6-30.6.1986.

Distribution: Burma; INDIA: Himachal Pradesh.

Oralia Malaise, 1961

Oralia Malaise, 1961. Ent. Tidskr. Arg. 82. H.3-4, p. 244-246.

Distribution: Burma; INDIA: Himachal Pradesh.

Oralia nigroclypeata Malaise, 1961

Oralia nigroclypeata Malaise, 1961. Ent. Tidskr. Arg. 82, H.3-4. p. 245.

Specimens examined: Himachal Pradesh: Dalhousie, Kalatop-2380 m, 5 females, 29.6 - 30.6.1986.

Clypea Malaise, 1961

Clypea Malaise, 1961. Ent. Tidskr. Arg. 82. H. 3-4, p. 246-247.

Distribution: Burma; INDIA: Arunachal Pradesh, Uttar Pradesh.

Clypea sinobirmana Malaise, 1961

Clypea sinobirmana Malaise, 1961. Ent. Tidskr. Arg. 82. H.3-4, p. 247.

Specimens examined: Arunachal Pradesh: Bomdila — 2800 males 1 female, 31.5.1989.

Distribution: Burma; INDIA: Arunachal Pradesh.

Clypea shanica Malaise, 1961

Clypea shanica Malaise, 1961. Ent. Tidskr. Arg. 82. H.1, 3-4, p. 247.

Specimens examined: Uttar Pradesh: Gopeshwar, Mandal — 2380 m, 2 ??, 15.6.1987.

Distribution: Burma; INDIA: Uttar Pradesh.

Indotaxonus unicolor Malaise, 1957.

Indotaxonus unicolor Malaise, 1957. Ent. Tidskr. Arg. 78. H.1, p. 22.

Specimens examined: Meghalaya: Smit — 1500 m, 1 female, 15.9.1985, Mawphlong 1500 m, 1 female, 17.9.1985. Himachal Pradesh: Sarkot — 2000 m, 2 females, 8.6.1983.

Distribution: Burma; INDIA: Meghalaya and Himachal Pradesh.

Malachiella nigerrima Muche, 1987.

Malachiella nigerrima Muche, 1987. Reichenbachia Band 24, Nr. 27, p. 179-181.

Specimens examined: Arunachal Pradesh: Bomdila — 2800 m, 7 males, 1.6-2.6.1989; Himachal Pradesh: Dalhousie, Kalatop — 2380 m, 2 males, 8.8.1982; Kasol — 1600 m, 1 male, 31.5.1984. Uttar Pradesh: Gopeshwar, Mandal — 2300 m, 1 male, 20.6.1983. West Bengal: Darjeeling — 2800 m, 1 male, 4.9.1929.

Distribution: Nepal; INDIA: Arunachal Pradesh, Himachal Pradesh, Uttar Pradesh, West Bengal.

Empronus Malaise, 1935

Empronus Malaise, 1935. Ent. Tidskr. Arg. 56. p. 175-176.

Distribution: Burma; Japan; INDIA: Arunachal Pradesh, West Bengal, Himachal Pradesh, Uttar Pradesh and Sikkim.

Empronus obsoletus Malaise, 1935

Empronus obsoletus Malaise, 1935. Ent. Tidskr. Arg. 56. p. 175-176.

Specimens examined: Himachal Pradesh: Dalhousie, Kalatop — 2380 m, 1 male, 27.6.1987.

Distribution: Burma; Japan; INDIA: Himachal Pradesh.

Kambaitina Malaise, 1961

Kambaitina Malaise, 1961. Ent. Tidskr. Arg. 82. H.3-4, p. 254-255.

Distribution: Burma; INDIA: Himachal Pradesh, West Bengal and Uttar Pradesh.

Kambaitina fulvipicta Malaise, 1961

Kambaitina fulvipicta Malaise, 1961. Ent. Tidskr. Arg. 82. H. 3-4, p. 254-255.

Specimens examined: Himachal Pradesh: Kasol — 1600 m, 2 females, 1 male, 29.5.1984. West Bengal: Darjeeling — 2600 m, 2 females, 2.5.1986. Uttar Pradesh: Ghangria — 3000 m, 1 male, 27.6.1987.

Distribution: Burma; INDIA: Himachal Pradesh, West Bengal, Uttar Pradesh.

Ferna punctifossa Malaise, 1961

Ferna punctifossa Malaise, 1961. Ent. Tidskr. Arg. 82. H. 3-4, p. 259.

Specimens examined: West Bengal: Darjeeling — 2800 m, 6 females, 20 males, 2.5 - 4.5.1986. Arunachal Pradesh: Bomdila — 2800 m, 4 males, 1.6-2.6.1989. Himachal Pradesh: Dalhousie, Kalatop — 2800 m (13 females, 9 males, 28.6-2.7.1986.

Distribution: Burma; INDIA: West Bengal, Arunachal Pradesh, Himachal Pradesh.

Population variation: Fulvous colour is pale yellow in the population.

Canonias inopinus Konow, 1901

Canonias inopinus Konow, 1901. Term. Fuz. Vol. 24, p. 65.

Canonias annulicornis Enderlein, 1919. S.B. Ges. naturf. Fr. Berlin, p. 369.

Canonias jacobsoni Forsius, 1929. Notul, ent. Helsingf. 9. p. 58.

Specimens Examined: Himachal Pradesh: Barkot, 1800 m, 2 males, 8.6.1983.

Distribution: Java; Sumatra; INDIA: Himachal Pradesh.

Busarbina Malaise, 1961

Busarbina Malaise, 1961. Ent. Tidskr. Arg. 82. H. 3-4, p. 256-257.

Distribution: Burma; INDIA: Uttar Pradesh.

Busarbina verticalis Malaise, 1961

Busarbina verticalis Malaise, 1961. Ent. Tidskr. Arg. 82. H. 3-4, p. 256.

Specimens examined: Uttar Pradesh: Gopeshwar, Mandal — 2300 m, 1 female, 2 males, 16.6.1987.

Distribution: Burma; INDIA: Uttar Pradesh.

Tala Malaise, 1935

Tala Malaise, 1935. Ark. Zool. 27 A, no. 9, p. 25.

Distribution: Burma; INDIA: West Bengal.

Eusunoxa cevlonica Malaise, 1932

Eusunoxa ceylonica Malaise, 1932. Ceylon J. Sci; Sect. B, 17, p. 147-148.

Specimens examined: Tamil Nadu: Madras, Kadamparai — 1200 m, 1 female, 10.5.1963 (Gift from USNM, Washington).

Distribution: Sri Lanka; INDIA: Tamil Nadu.

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THE BIRDS OF BANDHAVGARH NATIONAL PARK, M.P.[1]

HASHIM N. TYABJI[2]

Key words : birds, avifauna, Bandhavgarh N.P.

The paper is a record of the birds seen in Bandhavgarh National Park, Madhya Pradesh over a 4 years period (1986 - 1990, with a few updates and records from 1991 & 1992). 242 species belonging to 53 families were recorded. These include some species who's presence in this area was previously unsuspected. Although same of these records have been treated as unconfirmed, it is likely that a comprehensive survey of the moist forests of NE Madhya Pradesh & neighbouring Orissa will lead to the revision of the status & distribution of a number of species.

The moist forests of Madhya Pradesh that lie within the Gangetic Basin have, in the past, suffered even greater neglect at the hands of ornithologists than the rest of the state. Previous ornithological field-work in central India has generally been confined to areas within the peninsular drainage system (Osmaston 1927, Hewetson 1939, Wright 1942, Newton *et al.* 1986) or, within the Gangetic Basin, to the generally more arid areas of Gwalior (Ali 1939). D'Abreu's list (1935) of 409 species for the then Central Provinces consists of records obtained around Nagpur and the central areas of present day Madhya Pradesh. Hewetson (1955) published a list of 308 species for Madhya Pradesh based on 29 years of observations. However, he too states that only a few days were spent in the northern-most districts and presumably, even less time in what was then Vindhya Pradesh, where Bandhavgarh National Park is located.

Previous to this study, two lists were published of the birds of Bandhavgarh. One by N.K. Sinha (1978) who lists 72 species and the other by Guy Norman (Pamphlet of MPSTDC) who records 92 species.

The present paper is a record of birds seen by me over a discontinuous 4 year period. 242 species with status and habitat preference and some notes on their natural history, are included in the main list. Birds recorded by Sinha and Norman, but not by the author are shown in separate lists.

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Bandhavgarh National Park

The park is located in the north-eastern segment of Madhya Pradesh, along the northern flanks of the Satpura Range. Co-ordinates are 23° 30' to 23° 46' 45" N, 80° 11' 36" E (H.S. Pabla, pers. Comm.).

Bandhavgarh was originally the private hunting reserve of the erstwhile Maharaja's of Rewa and was constituted a National park in 1968 with an area of 105 sq. km, all of which comprises the present day Tala Range, with its H.Q. at village Tala, 32 km NE of Umaria, which is the H.Q. of the park. Apart from forest department guard-posts, there is no habitation within this range. In 1984 the area of the park was increased to 448 sq.km. With the inclusion of 3 new ranges, namely Kalwa, Magadhi & Khitauli. These contain 6 villages-3 revenue & 3 forest-that are slated for relocation. The final notification gazetting the extension area as part of the national park is still awaited.

Bandhavgarh is fortunate in that, unlike so many other parks, it forms part of a larger forest block. Apart from the 250 sq.km Panpatha Wildlife Sanctuary that is connected with the park to the north, there are also a number of smaller pockets of protected and reserve forest, amongst which are situated small agricultural communities.

The Study Area: This consisted of Tala Range, Garhpuri & Khitauli irrigation tanks - both situated in Khitauli range - and the surrounding areas. Same records were also taken from observations made at Majholi tank, 12 km north of Tala at the edge of the Panpatha Wildlife Sanctuary.

Topography: The park is hilly with extensive low-lying areas. The hills tend to run in a roughly east-west direction with spurs & ridges radiating to the north and south. The two main features of the park are Bandhavgarh fort - a plateau with steep, forested slopes rising 1200 feet (365 m) from the forest floor and culminating in sheer cliffs. The area of the plateau is 580 acres. It's smaller companion across a steep defile is Bandhaini, rising in terraces to almost the same height as Bandhavgarh. The mean altitude is between 1650 feet (500 m) and 2670 feet (810 m) (H.S. Pabla, pers. comm.). The soil is generally sandy or sandy-loam. The rock is soft feldspathic sandstone with extensive conglomerates (R. Gopal, pers. comm.).

Over 20 spring-fed streams either rise or flow through the park (H.S. Pabla, pers. comm.), of these the largest are the Umrar (western boundary), the Johilla (eastern boundary) and the Janadh. Within Tala range the Charanganga, Damnar, Banbai, Amba Nala and Andhyari Jhiriya are important. All these streams eventually flow into the Son river.

Vegetation and Habitats: Bandhavgarh falls within the Moist, Tropical Deciduous vegetational zone. The forest is dominated by Sal (*Shorea robusta*) and bamboo (*Dendrocalamus strictus*). Bamboo is, perhaps the most abundant species and is virtually ubiquitous. Although sal forms the climax vegetation and is the dominant species of tree, only a relatively small area of the park is under pure sal, i.e. 80% or more of canopy cover.

Within this general pattern of vegetation, a complex mosaic of smaller habitats exits as a function of topography, geology, climate & human activity. For the purpose of this study they have been identified as:

1). *Sal:* Where sal forms 80% or more of the canopy. Relatively small area of the park, most extensively found in the low-lying sections. Generally the quality of sal found in Tala range is of middle to poor quality (H.S. Pabla, pers. comm.). A fair amount of sal appears to be secondary although patches of mature sal exists, draped with massive *Spatholobus roxburghii* lianas.

2). *Sal Bamboo:* Often merging with sal. Extensive areas under this type of vegetation are found in the hills, especially on north-facing slopes.

3). *Mixed:* The commonest type. Contains a high, but variable, percentage of sal & bamboo along with species like *Terminalia tomentosa*, *T. bellerica*, *T. chebula*, *Diospyros melanoxylon*, *Madhuca indica*, *Anogeissus latifolia*, *Pterocarpus marsupium*, *Bridelia retusa*, *Careya arborea*, etc.

4). *Dry mixed:* Very little or no sal; high percentage of bamboo, *Boswellia serrata*, *Chloroxylon swietenia*, *Cochlospermum religiosum*, *Lagerstroemia parviflora*, *Buchanania lanzin*, *Sterculia urens*, etc. *Bauhinia vahlii* vines are also common here. This habitat is most commonly found on south-facing slopes and, where the rock comes close to the surface on the flat crests of ridges, the vegetation becomes more open with short grass and clumps of *Woodfordia fruticosa.*

5). *Moist mixed:* Although not a common habitat, it is important for certain species. The common species found here are sal, jamun (*Syzygium cuminii*) and *Terminalia arjuna* with the dense growth of jamun and *T. arjuna* often accompanied by *Ficus elastica* and various species of shrubs. This habitat is found along stream banks sheltered by hills and gorges, most notably along the Charanganga where it passes through a gorge called Jamunia and along the Banbai, Amba Nala, Damnar and Andhyari Jhiriya streams. Also at the northern base of Bandhavgarh fort in the area known as Shesh Shayya.

6). *Grasslands:* Most of the valley floors are covered by meadows which were originally centered around natural swamps but, in their present form, are relics of village fields. Although the grassland communities are complex, two major types of grassland are identifiable - the tall, dense grasslands of the marshy areas and the short and medium grasslands of the drier areas. The commonest grasses found in the park are species of *Saccharum*, *Phragmites*, *Themeda* and *Heteropogon* (R. Gopal 1990). Traditionally, fire, grazing pressure and

frost have been the factors that have helped perpetuate the grasslands and maintain that balance between the tall and the short species. At present, with the removal of fire as a regular occurrence and the reduction in grazing pressure due to the removal of all cattle, there is a noticeable increase in the colonisation of short grass areas by taller species as also the aggrandisement of forests at the expense of grasslands.

7). *Scrub:* Most often encountered in the extension zone, near villages and especially around Garhpuri and Khitauli tanks. In all cases this is the result of over-exploitation. The most common species that form the scrub are clumps of short *Lagerstroemia parviflora*, *Butea monosperma* and *Woodfordia fruticosa* all of which are often draped with *Ziziphus oenoplia*. The edges of the park and extension zone also contain fields and over-grazed meadows.

8). *Tanks and Jheels :* Two large irrigation tanks - Garhpuri and Khitauli - in Khitauli range are included in this study. Other bodies of water are Bhadrashila jheel, Bathan water-hole, the Damnar anicut, which is about 150 m long and 30 m wide and 4 m deep. Surrounded by forest, it is an ideal habitat for storkbilled kingfishers, common kingfishers and the greyheaded fishing eagle.

It must be noted that these habitats are not always well-defined and compartmentalised. A hill-side covered in dry mixed vegetation will often be seamed with lines of sal (often stunted) growing densely along a dry nala or gully. In other areas, mixed, dry mixed, sal etc., will be found in a haphazard patchwork, one grading into the other, depending on the moisture content of the soil. Bandhavgarh has also been inhabited for many centuries and much of the area is under secondary growth and open woodland as a consequence.

Climate : North Indian Monsoonal. Defined by a short, cold, winter from mid-November to end-February with low temperatures of 2°C encountered mainly in January. Hot dry summer from March to mid-June with highs of 44° - 46°C. The hottest month being May. Monsoon from mid-June to end-September. Average rainfall 117 cm (46 inches) most of which falls during the monsoon with some rain in November, January and February. (Records taken from Tala range).

List: The nomenclature and taxonomic arrangement follows the HANDBOOK OF THE BIRDS OF INDIA & PAKISTAN (Ali and Ripley 1968-74).

Identification is only of species and not sub-species.

The main list includes only those birds that were seen by the author.

Table 1 lists birds recorded by N.K. Sinha (1977-78) and Guy Norman (MPSTDC) but not by me.

Table 2 lists birds that have been treated as unconfirmed with their descriptions.

The period spent by me in Bandhavgarh were:

November 1986 - April 1987; October 1987 - April 1988; October 1988 - May 1989; August, September and November 1989; April 1990 - September 1990.

Key :

Habitats

S	-	Sal
S/B	-	Sal with Bamboo
Mx	-	Mixed
DM	-	Dry mixed
MM	-	Moist mixed
G	-	Grassland
Sc	-	Scrub
T	-	Tank

Abundance

1	-	Abundant
2	-	Common
3	-	Regular
4	-	Uncommon
5	-	Rare

Status

W	-	Winter visitor
PM	-	Passage Migrant
LM	-	Local Migrant
R	-	Resident
Sv	-	Summer visitor
Br	-	Breeding
V	-	Vagrant

SYSTEMATIC LIST

Common Name	Zoological Name	Habitat	Status	Abundance
		PODICIPEDIDAE		
Little Grebe	*Podiceps ruficollis*	T; Lily ponds.	R/LM (Movements subject to availability of water). Br. Juveniles seen in park on 20.9.88.	3
		PHALACROCORACIDAE		
Large Cormorant	*Phalacrocorax carbo*	T; Seen in Garhpuri tank in December & January.	W	4
Darter	*Anhinga rufa*	T; seen in Garhpuri, Bathan & Bhadrashila.	LM; most commonly seen from October to mid-February.	3
		ARDEIDAE		
Grey Heron	*Ardea cinerea*	T; also mud-flats & shallows.	LM; generally seen from October to March Reported Br. from nearby heronries.	4
Purple Heron	*Ardea purpurea*	T;reported form Khitauli tank on 18.12.88, sightings at Bhadrashila as well.	LM	4
Pond Heron	*Ardeola grayii*	T; marsh, streams, fields.	R; all birds in Br. plumage by May; juveniles seen on 26.9.89 at Garhpuri.	2
Cattle Egret	*Bubulcus ibis*	With cattle in fields, streams, grazed meadows, open DM & Sc.	LM; all birds seen in Br. plumage by May; Br. location unknown, seen from Oct. to early May.	3
Large Egret	*Ardea alba*	T; observed only at Khitauli and Bhadrashila.	LM; seen between December and June, Br. location unknown.	4
Median Egret	*Egretta intermedia*	T; streams.	LM; seen from October to mid-May. in Br. plumage on 3.5.89; Br.location unknown.	3
Little Egret	*Egretta garzetta*	T; streams.	LM; seen from December to mid-May; in Br. plumage at Bhadrashila on 3.5.89 and 11.5.89; Br. location unknown.	3
Black Bittern	*Ixobrychus flavicollis*	1 record from reed banks at Bhadrashila on 17.3.87.	LM?	5

Common Name	Zoological Name	Habitat	Status	Abundance
Chestnut Bittern	*Ixobrychus cinnamomeus*	Amongst reeds along stream banks.	S? seen in July 1991.	5
		CICONIIDAE		
Openbill Stork	*Anastomus oscitans*	T	LM? seen at Khitauli from December to early May; one record from Bhadrashila; Juvenlies at Khitauli 18.12.88.	4
Whitenecked Stork	*Ciconia episcopus*	T; marsh, flooded fields, streams.	R; Br. in and around the park large trees; nests through the monsoon.	3
Black Stork	*Ciconia nigra*	1 bird seen st Gopalpur tank.	Seen from 28.12.87 - 15.1.88, V?	5
Lesser Adjutant Stork	*Leptoptilos javanicus*	Marsh, fields, streams, open Mx.	R; no nests seen but juveniles seen at Bhadrashila on 16.2.87 & 27.2.87; generally solitary or in pairs but 4 adults seen together in Marsh on 13.5.90; 1 bird seen in moult 5.9.89 & 14.9.89; most commonly seen in S.	2
		THRESKIORNITHIDAE		
White Ibis	*Threskiornis aethiopica*	T; seen twice at Khitauli 18.1.87 & 24.12.87.	W	5
Black Ibis	*Pseudibis papillosa*	T; streams, fields, G.	R, LM; mainly seen inside the park from September- mid-May; 15 birds seen together at jheel on 28.4.90; Br. sites in villages around the park.	3
		ANATIDAE		
Barheaded Goose	*Anser indicus*	T; Khitauli.	W; seen on 18.1. 87.	5
Lesser Whistling Teal	*Dendrocygna javanica*	T; small ponds.	R/LM; movements subject to availability of water; seen at Bathan, Garhpuri, Bhadrashila during the monsoon, Br, 1 pr. seen with young at Bathan on 30.8.89.	2/3
Ruddy Shelduck	*Tadorna ferruginea*	T; at Khitauli.	W; seen once on 18.1.87; common on the Son river 30 km away 3 birds on Son 27.4.90.	5
Pintail	*Anas acuta*	T	W; seen at Majhauli 20.1.87.	5
Common teal	*Anas crecca*	T, Shallow Wetlands.	W	2
Common Pochard	Aythya ferina	T	W?V? seen once at Bathan 19.2.89.	5

Common Name	Zoological Name	Habitat	Status	Abundance
Cotton Teal	*Nettapus coromandelianus*	T	LM; recorded December & January.	4
Combduck	*Sarkidiornis melanotos*	T; wetlands.	R/LM; seen at Bathan through August & September & December; through the monsoon depending upon the presence of suitable water bodies.	4
		ACCIPITRIDAE		
Blackwinged Kite	*Elanus caeruleus*	G; forest edge.	LM? earliest seen mid-January, latest end-May; movements uncertain, 1 sub-adult in mottled plumage in G on 5.2.89.	3
Honey buzzard	*Pernis ptilorhyncus*	S, S/B, Mx & open Mx around villages.	R, S; population in the park seems to be augmented form March till September; no nests or young seen but birds with twigs and other nesting material observed on 1.5.90 & 14.5.90; 1 bird also seen breaking off twigs and leaves from jamun flying a short distance and then dropping them, pairs observed after March; both light and dark phase birds seen.	3
Black kite	*Milvus migrans*	Villages and fields only occasionally seen at the edge of the forest.	R	3
Shikra	*Accipiter badius*	S, S/B, Mx, DM, MM, Sc; sometimes seen soaring in tight circles over G.	R; numbers increase between March & October, Br; nests seen with 2 chicks on 10.6.90; on 20.6.90 1 chick seen almost fully fledged by this time, both parents seen close to the nest, juveniles seen between 30.8.89 & 16.11. 89, 1 juvenile seen attacking jungle babblers on ground, 1 adult male seen attacking a female koel in dense Mx, some birds seen hawking for termites on 21.6.90.	3
Sparrowhawk	*Accipiter nisus*	Mx	3 sightings 17.11.87, 16.1.88 & 3.2.89; W .	5
Goshawk	*Accipiter gentilis*	Mx, DM, Sc, fields.	W?PM? Seen from mid-Jan. to mid-April.	4
White-eyed Hawk	*Butastur teesa*	Fields, Sc, S/B,Mx.	From February onwards there is an increase in the number of birds seen in forest as opposed to open areas; presumably this is done for nesting; most birds seem to shift back into open country by mid-July; R.	3
Crested Hawk Eagle	*Spizaetus cirrhatus*	Mx, edge of G, MM, S.	R; juveniles regularly seen, observed feeding on Black-naped hare *(Lepus nigricollis)* on two occasions.	3

Common Name	Zoological Name	Habitat	Status	Abundance
Bonnelli's Eagle	*Hieraaetus fasciatus*	Mx, DM; soaring over G.	R; no nests or young seen, on 3.9.89 1 bird seen being attacked by a pair of Shahin Falcons.	4
Steppe Eagle	*Aquila rapax*	G	PM; all records from February & early March.	4
Lesser Spotted Eagle	*Aquila pomarina*	Near water.	2 records - 26.11.89 & 16.5.90.	5
Greyheaded Fishing Eagle	*Ichthyophaga ichthyaetus*	T; Wooded banks of streams; seen regularly at the Damnar anicut in May & June 1990.	V; movements uncertain -probably dependant upon water supply.	4
Black or King Vulture	*Sarcogyps calvus*	Sc, fields, Mx,G.	R; no young or nests seen.	3
Indian Longbilled Vulture	*Gyps indicus*	All habitats, nesting & roosting on ledges of cliffs.	R, nests & young seen.	2
Whitebacked Vulture	*Gyps bengalensis*	All habitats, nesting and roosting on cliffs and tall trees.	R	2
Egyptian or Scavenger Vulture	*Neophron percnopterus*	All habitats.	R; On one occasion 12 birds counted on a tree above a tiger kill; often seen rummaging through tiger droppings.	2
Hen Harrier	*Circus cyaneus*	G, fields.	PM? V? 2 records-22.11.87 & 23.11.87 of 1 male.	5
Pied Harrier	*Circus melanoleucos*	Fields.	1 record from March 1986; V.	5
Marsh Harrier	*Circus aeruginosus*	G; Fields, soaring over Mx.	W/Pm; records from September and October as well as from January.	4
Short-toed Eagle	*Circaetus gallicus*	Open forest, G.	1 record from 13.2.89.	5
Crested Serpent Eagle	*Spilornis cheela*	S, S/B, Mx, DM, MM; along the edge of streams & pools.	R; Birds seen mating 17.3.89, immatures seen on 9.9.89 & 12.9.89 moult observed 30.4.90 & 12.5.90.	2
Osprey	*Pandion haliaetus*	T	W; arriving by late August.	4
		FALCONIDAE		
Peregrine Falcon	*Falco peregrinus*	Mx; 1 pair regularly seen on cliffs of the fort.	R; this is the sub-species *peregrinator*.	4

Common Name	Zoological Name	Habitat	Status	Abundance
Eurasian Hobby	*Falco subbuteo*	Mx; along the cliffs of the fort hunting for Crag martins.	W; sparse sightings from November to February.	4
Eurasian kestrel	*Falco tinnunculus*	Open Mx, Dm, G.	W; mid-November to early May.	3
		PHASIANIDAE		
Painted Partridge	*Francolinus pictus*	G; edge of G and open forest, in monsoon seen and heard from Sc.	R; first calls heard from mid April to early October.	3
Grey partridge	*Francolinus pondicerianus*	Sc, DM	R; Br.	3
Jungle Bush Quail	*Perdicula asiatica*	G; open forest with G understorey, coveys of 12-16 birds seen regularly.	R; chicks seen in November & December.	2
Painted Spurfowl	*Galloperdix lunulata*	DM, Mx; in hilly terrain.	R	3
Red Jungle fowl	*Gallus gallus*	S, S/B, Mx	R	2
Common Peafowl	*Pavo cristatus*	S, S/B , Mx, G	R	2
		TURNICIDAE		
Common Bustard-quail	*Turnix suscitator*	Open Mx,G, forests with G understorey or low bush.	R	3
		GRUIDAE		
Sarus Crane	*Grus antigone*	G; marshy fields.	R, Br; 1 chick seen in July 1989 in G.	4
		RALLIDAE		
Whitebreasted waterhen	*Amaurornis phoenicurus*	T; reeds along streams.	LM/R; seen through the year but more during the monsoon; courting calls heard from March; Br. juveniles seen amongst reeds 31.8.89.	4
Moorhen	*Gallinula chloropus*	T	W	4/5
Coot	*Fulica atra*	Pond.	W? Seen on 8.3.92 at Gopalpur waterhole.	5
		JACANIDAE		
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	T; ponds.	LM	5 (Reported by Robert Fleming Jr. in Jan. 1992).

Common Name	Zoological Name	Habitat	Status	Abundance
Bronzewinged Jacana	*Metopidius indicus*	T	R; but subject to local movements; Br; Juveniles seen in November.	3
		ROSTRATULIDAE		
Painted Snipe	*Rostratula benghalensis*	T; ponds.	LM; 2 records 18.3.87 & 20.6.90.	5
		RECURVIROSTRIDAE		
Blackwinged stilt	*Himantopus himantopus*	T; mud-flats.	W/PM	3/4
		BURHINIDAE		
Stone curlew	*Burhinus oedicnemus*	Sc, fields; from end February to end June seen in open Mx & DM; when fire-lines are cleared along the edges of roads these birds are to be found nesting in the cleared area; 1 nest seen on 16.3.87 and chicks seen in another nest on 26.4.90; fire protection can thus be seen to be to the advantage of these birds.	R/LM; not seen often between July & December.	3
Great Stone Plover	*Esacus magnirostris*	Streams, T.	1 record from Khitauli on 18.12.88.	5
		CHARADRIIDAE		
Redwattled Lapwing	*Vanellus indicus*	T; streams, marshes, fields.	R; Br; a number of chicks seen in May.	2
Spurwinged Lapwing	*Vanellus spinosus*	T; sandy banks of streams; seen only on the banks of the Umrar river and Khitauli tank.	R	4
Yellow-wattled lapwing	*Vanellus malabaricus*	Sc; fields, open DM.	R; 1 pair with chicks (3) seen on 14.4.90;by 21.4.90 only 1 chick left.	3
Little Ringed Plover	*Charadrius dubius*	T; mud-flats.	W	3
Lesser Sand Plover	*Charadrius mongolus*	T; mud-flats.	W; 2 records - 10.11.88 & 18.12.88, on both occasions seen in large numbers.	4
Greenshank	*Tringa nebularia*	T; streams.	W; From early September to March.	3
Spotted Redshank	*Tringa erythropus*	T	1 record from Majhauli tank,on 20.1.87, W.	5

Common Name	Zoological Name	Habitat	Status	Abundance
Green Sandpiper	*Tringa ochropus*	T; marsh, streams, mud-wallows, etc.	W/PM; earliest seen early-September, latest mid-April.	3
Wood Sandpiper	*Tringa glareola*	T; marsh.	W/PM; seen from December to March; 12 + birds seen in shallow water at Bathan in March.	3/4
Common Sandpiper	*Tringa hypoleucos*	T; mud-flats.	W	4
Fantail Snipe	*Gallinago gallinago*	Mud-flats, marsh, shallow pools.	W	4
Temminck's Stint	*Calidris temminckii*	T; mud-flats,	W; 3 records - 18.1.87, 10.11.88, & 18.12.88 - all from Khitauli.	4
Little Stint	*Calidris minuta*	T; mud-flats.	W; 1 record from Khitauli on10.11.88.	5
		LARIDAE		
Indian River Tern	*Sterna aurantia*	T; rivers.	V? 1 record from Khitauli on 18.11.88.	5
Blackbellied Tern	*Sterna acuticauda*	T	1 record from Majhauli on 20.1.87; V.	5
		PTEROCLIDAE		
Painted Sandgrouse	*Pterocles indicus*	DM, Mx.	LM? Br. 1 chick seen with parents on 25.12.88; Birds seen in park from November to May.	3
		COLUMBIDAE		
Yellowlegged Green Pigeon	*Treron phoenicoptera*	All habitats wherever fruiting trees are found; generally flocks of 4+ birds seen; 60 counted on one fruiting pipal.	R	2
Blue Rock Pigeon	*Columba livia*	Ubiquitous; commonly seen around cliffs, tanks and buildings.	R	2
Rufous Turtle Dove	*Streptopelia orientalis*	Mx, S, S/B, G, fields, occasionally in open DM; in August & September seen more in open and where bamboo predominates.	R & PM; numbers increase markedly from mid-February to mid-April.	1/2
Indian Ring Dove	*Streptopelia decaocto*	Sc, fields, S/B, Mx; last 2 habitats used mainly between April and September.	R	2

Common Name	Zoological Name	Habitat	Status	Abundance
Red Turtle Dove	*Streptopelia tranquebarica*	Sc, fields, G in Sept. more often seen at the edge of the park, moving closer and into the park from April to September.	R	3/4
Spotted Dove	*Streptopelia chinensis*	Mx, S/B, G, Sc, open DM.	R	1
Little Brown Dove	*Streptopelia senegalensis*	Sc, fields, DM; prefers the open country around the park until April when it moves into DM areas in small numbers.	R	2/3
Emerald Dove	*Chalcophaps indica*	MM,S.	R; more commonly seen from April to October-perhaps numbers are augmented? calls heard from mid-March.	4
		PSITTACIDAE		
Large Parakeet	*Psittacula eupatria*	S,Mx, open Mx; seems to prefer relatively denser habitat then the other 2 parakeets in the park; is commonly seen on fruiting 'ber' *(Zizyphus jujuba).*	R	3
Roseringed Parakeet	*Psittacula krameri*	Mx, DM, Sc; seen feeding on seed of *Xanthium,* fruit of 'ber' and *Bridelia retusa.*	R	2
Blossomheaded Parakeet	*Psittacula cyanocephala*	Mx, open Mx:has a great partiality to the seed of the bamboo: seems to prefer more open country than *P. krameri.*	R; begins nesting at the end of February; fully fledged juveniles seen in company of adults by mid-May; their numbers drop sharply between mid-July and mid-September.	1/2
		CUCULIDAE		
Pied Crested Cuckoo	*Clamator jacobinus*	Mx, open Mx, DM.	Sv & possibly PM.	4
Common Hawk Cuckoo	*Cuculus varius*	Mx, S, S/B, occasionally DM.	R & Sv; numbers increase sharply from mid-March to October; earliest call heard in mid-March.	3
Indian Cuckoo	*Cuculus micropterus*	S, S/B, Mx.	Sv; earliest seen/heard end-April; latest on end-September; Br? no young seen.	3
The Cuckoo	*Cuculus canorus*	Mx,S, S/B.	Sv; earliest seen/heard 13.5.90; Br? no young seen.	3
Plaintive Cuckoo	*Cacomantis passerinus*	Mx, S, S/B.	Sv; earliest seen/heard mid-May, latest mid-September; Br? no young seen.	3/4

Common Name	Zoological Name	Habitat	Status	Abundance
Drongo-cuckoo	*Surniculus lugubris*	Mx, S/B open Mx.	Sv; earliest seen/heard end-May, latest end September; Br? no young seen.	4
Koel	*Eudynamys scolopacea*	Mx, MM, village groves.	Sv/LM; earliest seen mid/end-April, latest mid-November; Br?	3
Sirkeer Cuckoo	*Taccocua leschenaultii*	DM, S/B, open Mx.	R	4
Crow-pheasant	*Centropus sinensis*	Mx, DM, in bamboo and undergrowth.	R; Br-juvenile seen with adult on 14.9.89.	3
		STRIGIDAE		
Collared Scops Owl	*Otus bakkamoena*	Open Mx, DM.	R; earliest heard mid-March, latest mid-September.	3/4
Brown Fish Owl	*Bubo zeylonensis*	MM, along streams, 2 pairs identified - 1 along the Damnar anicut and the other at Jamunia.	R; Br; juveniles seen on 18.4.90.	4
Jungle Owlet	*Glaucidium radiatum*	Mx, S, S/B,DM, MM; lightly wooded to dense forests.	R; Br; nesthole seen in sal with 3 chicks seen on 25.4.90.	2
Brown Hawk-Owl	*Ninox scutulata*	1 record from 5.1.87 when a bird was heard calling just after dusk.	V	5
Spotted Owlet	*Athene brama*	Sc;fields, near villages.	R	3
Mottled Wood Owl	*Strix ocellata*	Mx, DM; well wooded country; often seen and heard near the gate of the park.	R; Br.	3/4
		CAPRIMULGIDAE		
Jungle Nightjar	*Caprimulgus indicus*	S,S/B, Mx,G.	R; earliest heard 19.2.89, calls heard until end-June.	2
Common Indian Nightjar	*Caprimulgus asiaticus*	Sc, fields, open Mx; commonly seen on roads at night.	R; heard from mid-March to end-May.	3
Franklin's Nightjar	*Caprimulgus affinis*	Fields, open DM, G.	R; call heard from end February to end June; also calls in the middle of the day if one happens to pass close by.	2
		APODIDAE		
Whiterumped Spinetail	*Chaetura sylvatica*	G, Mx.	LM; sporadic visitor, seen most often in May.	4/5

Common Name	Zoological Name	Habitat	Status	Abundance
House Swift	*Apus affinis*	Mx, G, T.	R	3
Crested Tree Swift	*Hemiprocne longipennis*	Mx,G, open Mx; once seen hawking over fire along with drongos, large groups often seen over G and water in the mornings and evenings.	R	2
		ALCEDINIDAE		
Lesser Pied Kingfisher	*Ceryle rudis*	T	R	3
Common Kingfisher	*Alcedo atthis*	T, streams, marsh.	R	3
Storkbilled Kingfisher	*Pelargopsis capensis*	Streams, Jheels with well-wooded banks; commonly seen at Jamunia.	R; Br. nest seen at Damnar anicut.	4
Whitebreasted Kingfisher	*Halcyon smyrnensis*	T, marsh, streams and from February onwards, increasingly in drier areas - S, S/B, Mx.	R; nestholes seen in banks of dry nalas and similar places.	2
		MEROPIDAE		
Green Bee-eater	*Merops orientalis*	G, open Mx, DM, Sc.	R; not seen in G from July to end September; during the monsoon in some places but not as widely dispersed as during the rest of the year.	2
Bluebearded Bee-eater	*Nyctyornis athertoni*	Mx,S,S/B; from November to May 6-8 birds seen regularly in the compound of the Bandhavgarh Jungle Camp; in March 1990, 2 large bee-hives were completely demolished by 6 birds. They would stay the whole day near the hives snapping up bees as they arrived at the hive and feeding on the larvae.	R; 1 pair seen mating on 16.4.90.	3

Common Name	Zoological Name	Habitat	Status	Abundance
		CORACIIDAE		
Indian Roller	*Coracias benghalensis*	G, Sc, Open Mx,DM, open S/B; prefers open areas from March onwards is seen more frequently in relatively thickly wooded country.	R; seen mating on 12.2.89 & 16.3.89; nestholes seen in sal 3 m above ground level and in jamun 7.5 m high; birds seen in nests through April & May.	2
		UPUPIDAE		
Hoopoe	*Upupa epops*	In open forests with little or no under-growth; Sc, fields.	R; nesthole seen in *B. retusa* 4.5 m high in April.	2/3
		BUCEROTIDAE		
Common Grey Hombill	*Tockus birostris*	Mx, open Mx; partial to banyan and pipal fruit.	R; in April lone birds were seen flying with fruit in their bills to an unlocated spot.	2
Malabar Pied Hombill	*Anthracoceros coronatus*	Mx, S, amongst ficus and mango trees on the fort; mainly seen on the fort and in the rest of the park quite frequently from March to June; for the first 2 weeks of May'90 a group of 13 birds were seen regularly in S & Mx around Bathan; some subadults were also present.	R	3/4
		CAPITONIDAE		
Large Green Barbet	*Megalaima zeylanica*	Mx, open Mx; partial to fruit of pipal, banyan, *B.retusa, F.glomerata,*etc.	R	2
Crimsonbreasted Barbet	*Megalaima haemacephala*	Mx, DM, Open Mx; feeds on all kinds of fruit; on fruiting pipal and banyan it is common to see upwards of 2 dozen birds; on 5.9.89 25+ birds gathered on an *Albizzia lebbek* and then flew into an unidentified bush with green berries, also take insects - on 1.6.90 one bird was observed darting up to take insects that looked like termites.	R; observed mating on 18.3.90 and 15.4.90; on the first occasion male remained mounted for 4 mins. He had something in his mouth which he offered the female after he got off; on the second occasion one bird-presumably the male-offered some fruit to the female which was accepted; both birds then flew separately into another tree, mating occurred 10 mins. later and lasted less than a minute.	2

Common Name	Zoological Name	Habitat	Status	Abundance
		PICIDAE		
Wryneck	*Jynx torquilla*	Sc, DM.	W? 2 records from March 1985 & December 1986.	5
Rufous Woodpecker	*Micropternus brachyurus*	S, Mx with high percentage of sal	Sv; Br. Juveniles seen on 17.9.89, earliest seen in park end-April, latest end-September.	4
Little scaly-bellied Green Woodpecker	*Picus myrmecophoneus*	S, S/B, Mx, Open Mx; almost always seen feeding low or at mid-level.	R	4
Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	Mx,DM, open Mx, S, MM; often in association of with Jungle Babblers.	R	2
Yellowfronted Pied Woodpecker	*Picoides mahrattensis*	Mx, S, open Mx; seen feeding on flowers of *Butea monosperma.*	R	2/3
Brown Crowned Pigmy Woodpecker	*Picoides nanus*	Mx,open Mx, DM, MM,S; in winter often seen in association with Common Iora.	R	2
Blackbacked Woodpecker	*Chrysocolaptes festivus*	Mx, open Mx, DM, S.	R; juveniles seen on 4.2.89.	3
		PITTIDAE		
Indian Pitta	*Pitta brachyura*	Mx, S/B; prefers somewhat open forest.	Sv & PM; earliest seen 7.5.90, numbers build up very rapidly after that and the birds are found all over the park in suitable habitat; very vocal and when their numbers peak the forest is filled with their calls; numbers seem to vary from year to year; earliest seen early-June, latest mid/end-January.	2
		ALAUDIDAE		
Bush lark	*Mirafra assamica*	Fields, Sc.	R	3
Ashycrowned Finch-lark	*Eremopterix grisea*	Sc, fields.	R; 1 male seen displaying on 8.9.89.	3
Rufous tailed Finch-lark	*Ammomanes phoenicurus*	Fields, Sc.	V	5

Common Name	Zoological Name	Habitat	Status	Abundance
		HIRUNDINIDAE		
Plain Sand Martin	*Riparia paludicola*	T, streams.	2 records - 16.1.87 & 18.1.87.	5
Crag Martin	*Hirundo rupestris*	G, cliffs.	LM; seen sporadically in the park from November to May.	4
Dusky Crag Martin	*Hirundo concolor*	G, cliffs, DM; seen hawking over G after ...ns in company of other swifts and swallows.	R	3
Swallow	*Hirundo rustica*	T; mainly seen at Khitauli and Garhpuri.	W	4
Wire-tailed Swallow	*Hirundo smithii*	T; in monsoon over flooded marshes.	R	3
Red-rumped or Striated Swallow	*Hirundo daurica*	G, Mx.	R; most abundant during the monsoon; at other times appears after rain.	2- during monsoon, 3/4 - at other times.
		LANIIDAE		
Baybacked Shrike	*Lanius vittatus*	From August to April in degraded Mx, Sc, ...lds; from April to ...ugust in Mx, S, G.	R; On 11.5.90 1 bird seen lining a cup shaped hollow in a horizontal sal branch with dry bamboo leaves and grass.	3
Rufousbacked Shrike	*Lanius schach*	November to April in G, fields & open Mx; April to end September they tend to stay in more wooded country.	R; 1 juvennile seen in open Mx on 13.9.89..	3
Blackheaded Shrike	*L. schach tricolor*	Seen in village meadow along the edge of the park.	December 1991.	5
Brown Shrike	*Lanius cristatus*	G, open Mx.	W;earliest seen mid-September, latest mid-April.	2
		ORIOLIDAE		
Golden Oriole	*Oriolus oriolus*	Mx, MM.	Sv, Br; seen in park between early April & October, juveniles seen in September.	2/3
Blackheaded Oriole	*Oriolus xanthornus*	Mx, S.	R; 1 juvenile seen on 11.9.89.	2/3
		DICRURIDAE		
Black Drongo	*Dicrurus adsimilis*	Sc, fields , G, open Mx from April to end September is also found in and S/B.	R; young commonly seen in September.	2

Common Name	Zoological Name	Habitat	Status	Abundance
Ashy Drongo	*Dicrurus leucophaeus*	Mx, S; generally prefers more wooded habitat than Black drongo, although there is considerable over-lap between April & September.	R, Sv; numbers greatly increase between April & October, Br.	2 - during monsoon; 4-at other times.
Whitebellied Drongo	*Dicrurus caerulescens*	Mx, DM, open Mx, S.	R	3
Haircrested Drongo	*Dicrurus hottentottus*	S, Mx.	LM? V? Seen on 16.12.88, 25.4.90 & 3.5.90	5
Greater Raquet-tailed Drongo	*Dicrurus paradiseus*	Mx, MM, S; in nesting season almost exclusively in S,S/B,MM.	R	3
		STURNIDAE		
Greyheaded Myna	*Sturnus malabaricus*	Open S,G,open Mx; enters park with the blossoming of the silkcotton.	R; subject to local movements, earliest sighted inside park 10.3.87, Br.	3
Brahminy Myna	*Sturnus pagodarum*	Sc, fields, open Mx; from April large numbers move into open S, S/B, presumably to nest.	R	2
Rosy Pastor	*Sturnus roseus*	Mx	V; 1 record of immature bird 10.4.90.	4
Pied Myna	*Sturnus contra*	Fields along streams.	R	3
Common Myna	*Acridotheres tristis*	G, Sc, S, Mx, open Mx fields; often seen on fruiting & flowering trees.	R	1
		CORVIDAE		
Indian Tree Pie	*Dendrocitta vagabunda*	In all habitats; seems to show a preference for S, Mx.	R; immature seen on 2.6.90.	2
House Crow	*Corvus splendens*	Tala village.	R	2
Jungle Crow	*Corvus macrorhynchos*	In all habitats; often first birds to appear at a tiger kill.	R; moult observed in early May.	1
		CAMPEPHAGIDAE		
Common Wood shrike	*Tephrodornis pondicerianus*	DM, Mx, S, S/B.	R; immature being seen fed on 1.6.90; from September to April often seen in mixed feeding flocks, associating most regularly with common Iora.	2

Common Name	Zoological Name	Habitat	Status	Abundance
Large Cuckoo-Shrike	*Coracina novaehollandiae*	Mx, open S, Sc, fields; often seen at the edge of forests and open areas.	R; immature seen in mid-September.	2
Smaller Grey Cuckoo-Shrike	*Coracina melaschistos*	Mx	W?V? 2 records - 14.12.86 1 bird in company of Quaker babblers, 19.3.90 - 2 birds actively hunting through mid and top level of canopy.	5
Blackheaded Cuckoo-Shrike	*Coracina melanoptera*	Mx, DM.	Sv? LM? in very small numbers, only 1 record from park - 18.5.90.	5
Longtailed Minivet	*Pericrocotus ethologus*	S, Mx, DM, MM.	W; seen from mid-November to end March.	3
Small Minivet	*Pericrocotus cinnamomeus*	Mx, open Mx, DM, S.	R; immatures seen from May to September; from September to March often seen in mixed feeding flocks; between April & August pairs or bird groups are often seen.	2
Whitebellied Minivet	*Pericrocotus erythropygius*	Sc	2 records - 2 birds on 7.11.86 and 2 birds on 13.12.86.	5
		IRENIDAE		
Common Iora	*Aegithina tiphia*	Mx, open Mx, DM, Sc; often seen in flowering *Viscum*.	R	2
Golden-fronted Chloropsis	*Chloropsis aurifrons*	S, Mx, open Mx; often seen together with *C.cochinchinensis* on flowering *Viscum*, *B. monosperma* & Silk cotton.	R; immatures seen in September.	3/4
Goldmantled Chloropsis	*Chloropsis cochinchinensis*	S, Mx, open Mx; as with the above species, also often seen in tangled *Zizyphus oenoplia* creepers; although there is considerable habitat overlap with *C. aurifrons*, this bird is more often seen in more open, lightly wooded country.	R; immatures seen in September.	3
		PYCNONOTIDAE		
Redvented Balbul	*Pycnonotus cafer*	G, open Mx, Sc,open S/B, DM; found in large numbers in fruiting *B. retusa* and *Z.oenoplia* and occasionally pipal.	R	2

Common Name	Zoological Name	Habitat	Status	Abundance
		MUSCICAPIDAE		
Spotted Babbler	*Pellorneum ruficeps*	Mx, S/B; shows a marked preference for bamboo.	R; the low, musical 'beat-you' call heard from mid-April to end September.	4 Perhaps more abundant than indicated here but difficult to see.
Slatyheaded Scimitar Babbler	*Pomatorhinus schisticeps*	Mx, S/B; another habitue of bamboo.	R	3/4
Rufousbellied 3	*Dumetia hyperythra* Babbler	Mx,G; in bushes, shrubs and clumps of fallen bamboo; in Mx seen with Tailor Bird and Tickell's Blue Flycatcher.	R	
Yelloweyed Babbler	*Chrysomma sinense*	G, grass understorey and shrubby growth, bamboo.	R	3
Large Grey Babbler	*Turdoides malcolmi*	Sc	R	4
Jungle Babbler	*Turdoides striatus*	In all habitats; Golden Backed Woodpeckers,Large Raquet-tailed Drongos and Tree pies commonly associated with flocks of this species.	R	1
Quaker Babbler	*Alcippe poioicephala*	Mx, MM, S/B; Preference for bamboo.	R; juveniles seen 5.9.89.	4
Brown Flycatcher	*Muscicapa latirostris*	Mx, DM, edge of forest and open areas, G.	PM; sightings between 11.9.89 & 21.9.89 & 26.4. 90 - 3.5.90.	3/4
Redbreasted Flycatcher	*Muscicapa parva*	Sc, open Mx, Mx, edge of MM, open S/B.	W; earliest seen on end-September, latest on mid-April; males seen in Br. plumage on 5.11.89 & 9.4.90.	Numbers peak between mid-November & mid-March; 2
Whitebrowed Blue Flycatcher	*Muscicapa superciliaris*	Mx, MM.	W;earliest seen early-November, latest mid-March.	4
Tickell's Blue Flycatcher	*Muscicapa tickelliae*	Dm,Mx,S/B,occasionally in MM; marked preference for bamboo thickets and other low vegetation from which it makes forays from low perches.	R	2

Common Name	Zoological Name	Habitat	Status	Abundance
Verditer Flycatcher	*Muscicapa thalassina*	Mx, open Mx, MM, S.	W	4
Greyheaded Flycatcher	*Culicicapa ceylonensis*	MM, Mx.	W; earliest seen mid/end November, latest mid-March.	3
Whitebrowed Fantail Flycatcher	*Rhipidura aureola*	Mx,open Mx, Sc, DM, S.	R; immature seen on 28.8.89.	2/3
Paradise Flycatcher	*Terpsiphone paradisi*	Mx, open Mx, S, MM.	SV; Br. earliest seen mid-March, latest end-September.	3
Blacknaped Flycatcher	*Hypothymis azurea*	S, Mx, MM, open Mx, dense bamboo thickets.	R;1 pair seen nesting in Sal on 20.4.89.	3
Streaked Fantail Warbler	*Cisticola juncidis*	G	R	2
Franklin's Wren Warbler	*Prinia hodgsonii*	G,Sc, grass understorey, bamboo.	R;in breeding season leaves G for forest; Br. plumage seen earliest on 8.2.89; immatures seen in September.	2
Jungle Wren Warbler	*Prinia sylvatica*	G, grass understorey and undergrowth in forest, bamboo.	R; 1 bird seen displaying on 1.9.89 repeatedly shooting up and then diving vertically, wobbling slightly, to perch, calling all the time; immatures seen through September.	2/3
Tailor Bird	*Orthotomus sutorius*	Mx, with a preference for bamboo and tangled undergrowth, Sc; also seen feeding on *Madhuca indica* flowers and fruiting banyan.	R	2
Indian great Reed Warbler	*Acrocephalus stentoreus*	Dense, rank reeds and marshy grassland.	PM? 3 records - 21.11.86, 16.11.87 19.11.87.	5
Blyth's Reed Warbler	*Acrocephalus dumetorum*	G,Sc, open Mx, in undergrowth.	PM/W; earliest seen end-September latest early-May; numbers highest between late September and early November and from mid-April to early May.	3/4
Lesser Whitethroat	*Sylvia curruca*	Sc, DM, an Undergrowth.	PM	4
Brown Leaf Warbler	*Phylloscopus collybita*	G, open Mx, DM.	W; seen from December to March.	3/4
Tickell's Leaf Warbler	*Phylloscopus affinis*	Mx	PM/W seen from December to March.	4

Common Name	Zoological Name	Habitat	Status	Abundance
Olivaceous Leaf Warbler	*Phylloscopus griseolus*	DM, open Mx, Mx.	W; earliest seen end-October, latest end-March.	3
Dusky Leaf Warbler	*Phylloscopus fuscatus*	Sc, open DM, often seen feeding on ground.	W	3/4
Yellowbrowed Leaf Warbler	*Phylloscopus inornatus*	Mx, open Mx, MM,S, DM.	W; earliest seen end-September, latest mid-March.	2
Dull Green Leaf Warbler	*Phylloscopus trochiloides*	Mx, S, open Mx, DM, MM, S/B.	W/PM; earliest seen early-September, latest mid-April; in first half of September numbers very large with groups of 10+ birds commonly seen; numbers lessen somewhat during the rest of the winter, but it remains one of the commonest leaf warblers.	2
Blyth's Leaf Warbler	*Phylloscopus reguloides*	MM	PM; with a few staying on for the winter; between 28.9.89 & 30.9.89 large numbers were seen in open Mx & MM.	3/4
Rubythroat	*Erithacus calliope*	Tall, rank grass, edge of bamboo and grass.	W	4
Bluethroat	*Erithacus svecicus*	Tall grass.	1 record from within the park on 19.12.88, although commonly seen in village fields, especially mustard, during winter.	5
Magpie-Robin	*Copsychus saularis*	S/B, Mx,Sc, open Mx, DM, fields.	R	1
Black Redstart	*Phoenicurus ochruros*	DM, open Mx, S/B, Sc, fields.	W;earliest seen mid-September, latest mid-April.	3
Stone Chat	*Saxicola torquata*	G, Sc, fields.	W; earliest seen mid-September, latest mid-March.	2/3
Pied Bush Chat	*Saxicola caprata*	Sc, fields.	Very few records; 1 from 26.12.88.	5
Dark-Grey Bush Chat	*Saxicola ferrea*	G, Mx, open Mx, DM.	W; first recorded from Bandhavgarh on 19.12.86; in the winter 1988-89 they were present in large numbers more than in previous years in 1989-90 numbers were very low; earliest seen mid-November, latest mid-March.	2/3
Indian Robin	*Saxicoloides fulicata*	DM, Sc, open Mx, fields open S/B.	R	2
Blueheaded Rock Thrush	*Monticola cinclorhynchus*	MM	W	4
Blue Rock Thrush	*Monticola solitarius*	DM; in rocky hilly country.	W	4

Common Name	Zoological Name	Habitat	Status	Abundance
Orangeheaded Ground Thrush	*Zoothera citrina*	MM, Mx, S/B; through winter prefers moist undergrowth but disperses into other habitats from end March.	R; Sv; numbers increase from April to August. Note: the subspecies found here *Z.c. cyanotus* or the Whitethroated Ground Thrush of the peninsula; there have been reports of *Z.c. citrina* but unconfirmed.	2/3
Plainbacked Mountain Thrush	*Zoothera mollissima*	MM, Mx, amongst bamboo always in hilly country.	W; previously unrecorded from central India but seen once or twice every winter.	5
Smallbilled Mountain Thrush	*Zoothera dauma*	MM, Mx, S.	W	3/4
Tickell's Thrush	*Turdus unicolor*	MM,Mx;in fruiting trees and bushes, especially *B.retusa;* 1 bird seen feeding on pipal.	W; earliest seen end-October;latest early May.	3
		PARIDAE		
Grey Tit	*Parus major*	All habitats.	R	2
		SITTIDAE		
Chestnutbellied Nuthatch	*Sitta castanea*	Mx, S, open Mx.	R; 1 male seen disappearing into hole in sal with a grub 17.9.89.	3
Spotted Grey Creeper	*Salpornis spilonots*	DM	1 record from 1.11.86.	5
		MOTACILLIDAE		
Indian Tree Pipit	*Anthus hodgsonii*	S/B, open Mx, G.	W; earliest seen end-September, latest mid-April.	2
Paddyfield Pipit	*Anthus novaeseelandiae*	G, fields.	R	2
Tawny Pipit	*Anthus campestris*	Fields, short grass.	W	4
Brown Rock Pipit	*Anthus similis*	Open DM in hilly country.	W	3
Forest Wagtail	*Motacilla indica*	Mx	1 record 10.5.90; V?	5
Yellowheaded Wagtail	*Motacilla citreola*	Edge of water, short marshy grassland.	PM/W; on 28.4.89, 24 birds were seen together, most in Br. plumage.	4
Grey Wagtail	*Motacilla cinerea*	Edge of water, MM, marshy grassland.	W;earliest seen end-August, latest end-April.	2
Pied Wagtail	*Motacilla alba*	T, jheels.	W	4
Large pied Wagtail	*Motacilla maderaspatensis*	T, jheels.	R	3

Common Name	Zoological Name	Habitat	Status	Abundance
		DICAEIDAE		
Thickbilled Flowerpecker	*Dicaeum agile*	Mx, MM, open Mx, S; commonly seen on *Viscum*.	R	2/3
Tickell's Flowerpecker	*Dicaeum erythrorhynchos*	Open Mx, Mx, S/B.	R	3
		NECTARINIIDAE		
Purple Sunbird	*Nectarina asiatica*	Mx, open Mx, S when *Spatholobus roxburghii* vine is in flower; at other times on *Viscum, Woodfordia fruticosa, B. monosperma, Madhuca indica* and silk cotton flowers; on 13.9.89 1 male was seen trying to take a small *Nephila* spider from it's web but was unsuccessful; it then broke the twigs anchoring the web and then took the spider from the sagging web.	R; males in Br. plumage by mid February and in winter plumage by mid September; nests seen in G as well as various bushes in April.	2
		ZOSTEROPIDAE		
White-eye	*Zosterops palpebrosa*	Mx,open Mx,S/B,Sc, MM; when *W. fruticosa* is in flower many birds seen with orange stained foreheads.	R; 1 immature seen on 28.8.89; large flocks seen through winter but by end April generally only pairs or small groups are seen.	2
		PLOCEIDAE		
House Sparrow	*Passer domesticus*	Villages, guard posts.	R	2
Yellow throated Sparrow	*Petronia xanthocollis*	Sc, fields, open Mx, DM; large flocks of 50+ birds seen feeding on ground from January to April; they disappear between July & October.	R/LM?	1/2
Whitethroated Munia	*Lonchura malabarica*	Open Mx, Sc,in bamboo.	R	3
Whitebacked Munia	*Lonchura striata*	G,open Mx,S/B in grass understorey and bamboo.	R	3

Common Name	Zoological Name	Habitat	Status	Abundance
Spotted munia	*Lonchura punctulata*	G, open Mx, Sc, in grass understorey, S/B.	Sv, LM? seen from July to November; Br; 1 immature seen on 26.11.89 in tall grass.	3
		FRINGILLIDAE		
Common Rosefinch	*Carpodacus erythrinus*	G, Mx, feed on bamboo seeds.	W	2/3
		EMBERIZIDAE		
Whitecapped Bunting	*Emberiza stewarti*	Sc, Mx, amongst rocks.	W; 2 records - 26.3.85 & 19.12.86.	5
Crested Bunting	*Melophus lathami*	G	1 record of a pair seen on 22.4.89; V?	5

TABLE 1

BIRDS RECORDED BY N. K. SINHA AND GUY NORMAN BUT NOT BY THE AUTHOR

1	Brahminy Kite	*Haliastur indus*	Reported by N.K. Sinha; an unmistakable bird, probably a vagrant to Bandhavgarh.
2.	Black Partridge	*Francolinus francolinus*	Reported by N.K. Sinha; it could be that this species was confused with the somewhat similar painted partridge *(Francolinus pictus)*, which is common. In all these years I have neither heard the call of the Black Partridge nor had it reported by anyone else.
3.	Indian Sandgrouse	*Pterocles exustus*	Reported by N.K. Sinha.
4.	Whitecheeked Bulbul	*Pycnonotus leucogenys*	Reported by N.K. Sinha.
5.	Ashy Wren-warbler	*Prinia socialis*	Reported by Guy Norman. This is normally a bird quite easily seen and it is surprising that apart from Norman, nobody else who has spent any length of time at Bandhavgarh has seen this bird. It could have been a case of mistaken identification or confusion with *P. hodgsonii.*
6.	Yellowcheeked Tit	*Parus xanthogenys*	Reported by Guy Norman.
7.	Eurasian Tree Pippit	*Anthus trivialis*	Reported by N.K. Sinha; could be a PM.
8.	Baya Weaver	*Ploceus philippinus*	Reported by N.K. Sinha; this bird is found close to the park, in the fields near Umaria.
9.	Scarlet Minivet	*Pericrocotus flammeus*	Reported by Guy Norman. The red minivet commonly seen in Bandhavgarh is the Longtailed Minivet *(Pericrocotus ethologus)*. The fact that this species is not mentioned in Norman's list could indicate a case of confusion between the two and misidentification.

TABLE 2
FIELD DESCRIPTION OF SOME UNCONFIRMED SPECIES, WITH POSSIBLE IDENTITIES

1. *Description:* A very pale Accipiter; size - slightly smaller than Shikra; upper parts slate grey; underparts of wings strikingly white with no lines or markings; wing-tips- very black, with extent of black varying in different individuals; black tips seen in dorsal view as well with white mirrors at base of primaries. Throat and chin very pale with no mesial stripe. Rest of underparts with rufous wash fairly dark on some individuals and generally darker on flanks; eye - orange-red.

Habitat: Mixed Forest & forest edge.

Sightings: The First sighting of this bird was on 17.3.87. During the summer of 1987 quite a few birds of this description were seen in the park and some were seen carrying twigs and other material for a possible nest. It is not known how long these birds stayed - they were certainly gone by October. In 1988 the first sighting of this bird was on 19th March with regular and increasing sightings after that through April.

Identification: While it is possible that all these birds were very pale Shikra's *(A. badius)*, it seems unlikely. For one thing very careful note was taken of underwing markings and on a number of occasions it was confirmed that these birds lacked even the faintest trace of any lines. They also lacked a mesial stripe.

The description does, however, fit that of the Chinese or Horsefield's Goshawk *(A. soloensis)*.

2. *Description:* Small flycatcher, about 11 cm. General aspect - brown; darker on head and upper back; lower back, wings and tail more olivaceous. Undertail coverts and vent - white. Short, indistinct buff supercilium. Forehead - brighter brown; chin and throat - orange; breast browner; rest of underparts - muddied white. Bill - black; legs - flesh cloured. Not shy; habit of flicking tail while calling.

Habitat: Mature mixed riparian forest on bank of Charanganga stream, amongst dense undergrowth.

Sighting: Seen on 18.2.88.

Identification: Description fits female Rufousbreasted Blue Flycatcher *(Muscicapa hyperythra)*. As per Ali & Ripley (1968 - 74), Bandhavgarh falls outside of the known range of this bird.

3. *Description :* Length 15 - 18 cm; upperparts- brown with a touch of rufous; yellowish-grey bill, fairly thin and slightly curved. A very inconspicuous, pale supercilium. Short, dark eye - line. Long, broad tail very different from that of a *Prinia*; square-tipped when held together. Central tail feathers darker than the rest of tail. This is constantly rotated and flipped when the bird is sitting. Underparts - olivy, yellow wash to grubby cream; flanks rufescent buff. Undertail coverts - dirty white. Outer undertail feathers - barred, noticeably around the terminal half. Legs - pale, fleshy grey. Floppy flight.

Habitat: Grassland - marshy.

Sighting: 1 adult and 3 immatures seen on 1.9.89. 1adult seen on 12.9.89.

Identification: The bird that most closely fits this description according to the HANDBOOK (Ali & Ripley 1968 - 74) is the Broadtailed Grass Warbler *(Schoenicola platyurus)*. Although the habitat that this bird was seen in corresponds to that mentioned in the HANDBOOK, the range ascribed it is in the southern hills, nowhere near Bandhavgarh. This bird was not seen again.

4. *Description:* Forehead - blue; rest of underparts - blue-black. Underparts - dark blueblack. Tail - dark with white patches on outer tail feathers near base. The bird was slowly raising and lowering it's tail while flaring it and the white patches were clearly visible.

Habitat: Mixed forest. Perched low on bamboo.

Sightings: Seen on 14.1.87.

Identification: The description fits that of a male White-tailed Blue Robin *(Cinclidium leucurum)*. It is, however, well south of the range described in the *Handbook* (Ali & Ripley 1968 - 74).

It must be stressed that all the above records are from field sightings and identifications are tentative and cannot be treated as confirmed.

Of the 77 families of Indian birds, 53 are represented in Bandhavagrh. Since only a relatively small area of the park was studied on a regular basis, it seems almost certain that more species will be added to this list in the future. The status and abundance of many species will also require considerable work to arrive at a more accurate understanding. As has been pointed out in other

studies of small areas, a species might utilise different habitats in different seasons and in the process move outside the limits of the area under study and so be classified a local migrant when in other circumstances - say for instance the expansion of the boundaries of the study area to include all the habitat types that it uses - it would be classified as a resident. These and other anomalies resulting from limited area studies, can only be adequately removed with the initiation of more extensive studies.

The fact that some species who's presence had hitherto been unsuspected in central India like the Plainbacked Mountain Thrush *(Zootheramollissima)* which is a regular, if sparse, visitor, would indicate that a more thorough survey of the whole of the north-eastern qudrant of M.P. and adjoining Orissa, would yield some interesting information on the distribution patterns of Himalayan/sub-himalayan species. It is also evident that species like the Goldfronted Chloropsis *(Chloropsis aurifrons)*, Dusky Leaf Warbler *(Phylloscopus fuscatus)*, Longtailed Minivet *(Pericrocotus ethologus)*, Dark-grey Bush Chat (Saxicola ferrea), etc. are in fact more widely distributed and abundant than previously thought.

Vultures are also doing well in Bandhavgarhh and it's surrounds. The Indian King or Black Vulture *(Sarcogyps calvus)*, although rare in nature, is found in relative abundance here. An interesting difference between Kanha and Bandhavgarh national parks, is the almost complete absence of the Indian Longbilled Vulture *(Gyps indicus)* in the former, while in the latter it is just as abundant as the Whitebacked Vulture *(Gyps bengalensis)*. One reason for this difference is probably the fact that in Kanha there are no cliffs, which form the favoured roosting and nesting site for the Longbilled, whereas in Bandhavgarh these are extensively found.

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A TAXONOMIC ACCOUNT OF *BULBOPHYLLUM* THOU. (ORCHIDACEAE) FROM BANGLADESH[1]

MOKTER AHMED, M.K. PASHA AND M.A. AZIZ KHAN[2]

(With five text-figures)

Key words: taxonomy, *Bulbophyllum*, Orchidaceae, Bangladesh

The genus *Bulbophyllum* Thou. of the family Orchidaceae is represented in Bangladesh by four species including a variety, *B. neilgherrense* Wight and *B. sessile* (Koen.) J.J.S. are recorded for the first time in Bangladesh. A new variety *B. lilacinum* var. *sorocianum* Ahmed *et al.* is also reported . A Key to the species and variety has been given.

INTRODUCTION

In a wide sense there are probably 1000 species of the genus *Bulbophyllum* Thou. distributed through tropical Africa and Asia; Australia, New Zealand and S. America (Santapau and Kapadia 1966). The name *Bulbopbyllum* is derived from the Greek words bolbos = bulb, and phyllon = leaf, in allusion to the bulb which bears leaf on the top (Santapau and Kapadia 1966). According to Hooker (1890) there are about 79 species under the genus present in British India. Later Grant (1895) reported 41 species from the region of Burma, adjacent to Bangladesh. On the other hand 62 species of the genus have been reported from India by Pradhan (1979). In other adjacent areas Holttum (1964) recorded 127 species from Malaya and only 11 species from Sri Lanka (Jayaweera 1981). Only two species *B. lilacinum* Ridley and *B. lobbi* Lindl. have been reported from the present Bangladesh area by Khan and Halim (1987), and Hooker (1890) from Cox's Bazar and Chittagong, respectively. This work aims at studying the genus from Bangladesh, comprising four species (including the earlier reported two species) and *B. neilgherrense* Wight and *B. sessile* (Koen.) J.J.S.. which are reported here as new records. A new variety of *B. lilacinum* var. *sorocianum* Ahmed *et al.* is also reported here after critical study of literature (Prain 1903, Heinig 1925, Cowan 1926, Datta and Mitra 1953, Sinclair 1955).

The herbarium and live specimens are housed at the Botany Department and Orchidarium of Chittagong University, Chittagong, Bangladesh respectively.

KEY TO THE SPECIES AND VARIETY OF *Bulbophyllum*

1. Flowers solitary 2

2. Rhizome pendulous, pseudobulbs appressed to the rhizome, pedicellate ovary ± 1 mm long, petals ± 1 mm long ..... *B. sessile*

2. Rhizome creeping, pseudobulbs erect on the creeping rhizome, pedicellate ovary ± 7.5 cm long, petals ± 2.0 cm long ..... *B. lobbi*

1. Flowers racemose 3

3. Raceme compact, flowers many (± 30) and spotted, petals entire with long cilia 4

4.Floral bracts longer than pedicellate ovary, sidelobes of lip round and toothed ..... *B. lilacinum*

4.Floral bracts shorter or equal to the pedicellate ovary, sidelobes of lip ± falcate and entire ..... *B. lilacinum* var. *sorocianum*

3. Raceme lax-flowered, flowers fewer (± 11) and unspotted, petals denticulate without cilia ..... *B. neilgherrense*

[1] Accepted January 1993.

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ENUMERATION OF THE SPECIES

1. **B. lilacinum** Ridley, J. Linn. Soc., 32: 276 (1896); Holttum, Fl. Malaya, 1: 460 - 461 (1964); Balakrishnan and Nair, in Bull. Bot. Surv. Ind., 18 (1-4): 150-151 (1976); Khan and Halim, Bang. J. Bot., 16(2): 203 (1987). (Fig.1)

The additional identifying characters of the species given here are not mentioned by Khan and Halim (1987). The lateral lobes of the column more or less 2-toothed and acute. Pollinia 4, attached in pairs, 0.5 x 0.5 mm (combination of two), outer two larger than the inner ones, slightly curved. Stigmatic surface 1 x 0.5 mm.

Flowering scape: Early October; **Flowering time:** late October-early November; **Fruiting Time:** Unknown.

Geographical distribution: Malaya Peninsula, India and Bangladesh.

Specimen examined: Cox's Bazar district: Ukhia, Koto Palong, 20.12.1986, Ahmed 71.

2. **B. lilacinum** Ridley var. **sorocianum** Ahmed *et al.* var. nov. (Fig.2)

var. **sorocianum** Ahmed *et al.* var. nov.- varietate *lilacinum* Ridley affinis, sed different folium apice abrupte reflexum, flores bracteae breve flos in sicco pellucidus, scapus minor quam parte pseudobulbo, racemus inclino pseudobulbo et laxissimus, flore largior et cuprum brownicum, lateribus labellum sensim falcata, entiris, acutae.

Holotypus: Lectus in Ukhia, Koto Palong, Cox's Bazar district, epiphytica die a *Syzygium fruiticosum* (Roxb.) DC. die 20.12. 1986 by Ahmed et positus in herbario die Botany Department, Chittagong University, Chittagong, Bangladesh sub numero accessionis 71 (a).

var. **sorocianum** Ahmed *et al.* var. nov.- allied to var. *lilacinum* Ridley but differing from it having leaf apex more reflexed, floral bracts shorter than the pedicellate ovary, scape less than half of the pseudobulbs, raceme inclined to pseudobulb and loose, larger flower and copper brown colour, sidelobes of lip more or less falcate, entire and acute.

Flowering scape initiation: Late September; **Flowering time:** More or less mid October-late October; **Fruiting time:** November onwards.

Holotype: Collected from Ukhia, Koto Palong, Cox's Bazar district, Epiphytic on *Syzygium fruiticosum* (Roxb.) DC. on 20.12.1986 by Ahmed and has been deposited in the Herbarium at Botany Department , Chittagong University, Chittagong, Bangladesh under accession number 71(a).

3. **B. Lobbii** Lindl., Bot. Reg. 33: sub. t. 29 (1847); Hook. f., Fl. Brit. Ind., 5: 755 (1890); Grant, Orch. Burma, 41 (1895); Holttum, Fl. Malaya, 1: 424 (1964). Syn. *B. henshallii* Lindl. in Gard. Chron., 422(1852); *B. siamanse* Reichb. f. 1 c: 572(1867). (Fig.3)

Hooker (1890) added Chittagong to the plant's habitat and mentioned in his description that the petals were 9-nerved. We did not find such 9-nerved petals instead only 3-nerved forms. According to Holttum (1964) *B. lobbii* was certainly one of the finest *Bulbophyllum*, but it was not easy to grow in the low lands of Malaya. *B. lobbii* is perhaps closely allied to *B. affine*, but the scape and pedicel are distinctly longer.

Flowering scape initiation: late July; **Flowering time:** Early June-Mid June; **Fruiting time:** Unknown.

Geographical distribution: Widely distributed in Indonesia, Malaya, Burma and Bangladesh.

Specimen examined: Cox's Bazar district : Ukhia, Koto Palong, 20.12. 1986, Mokter 63.

4. **B. neilgherrense** Wight, Icon., 5(1): 6, t. 1650 (1851); Hook. f. Fl. Brit. Ind., 5: 761(1890); Santapau & Kapadia, Orch. Bombay, 195(1966); Pradhan, Ind. Orch., 2: 399(1979); Singh, Bull. Bot. Surv. Ind., 23(3 & 4): 205 (1981). Syn. *Phyllorchis neilgherrense* (Wt.) O. Kuntze, Rev. Gen. Pl.2: 677 (1891). (Fig.4)

This species has been observed by Santapau and Kapadia (1966) to be both epiphytic and lithophytic, and rarely flowers in cultivation. They noted the distinguishing odour of the flowers which probably is a great attraction for carrion flies,

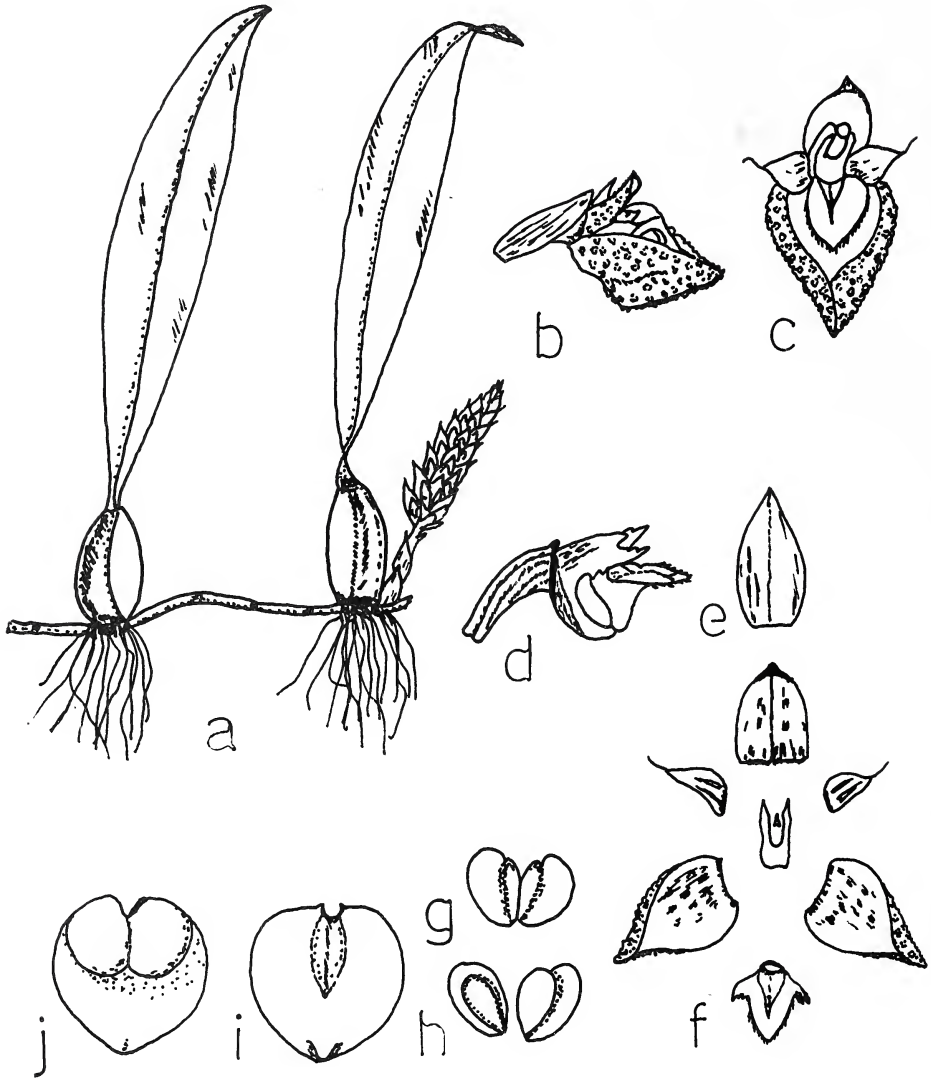

Fig. 1. *Bulbophyllum lilacinum* Ridley: (a) habit sketch with inflorescence (x ½); (b) flower from side showing bract (x ½); (c) flower from front (x 4); (d) pedicellate ovary, column, foot and lip attached from side (x 4); (e) floral bract (x 3); (f) sepals, petals, lip spreadout, and column from inside (x 3); (g) pollinia (x 20); (h) pollinia spreadout (x 20); (i) operculum from front (x 20); (j) operculum from inside (x 20).

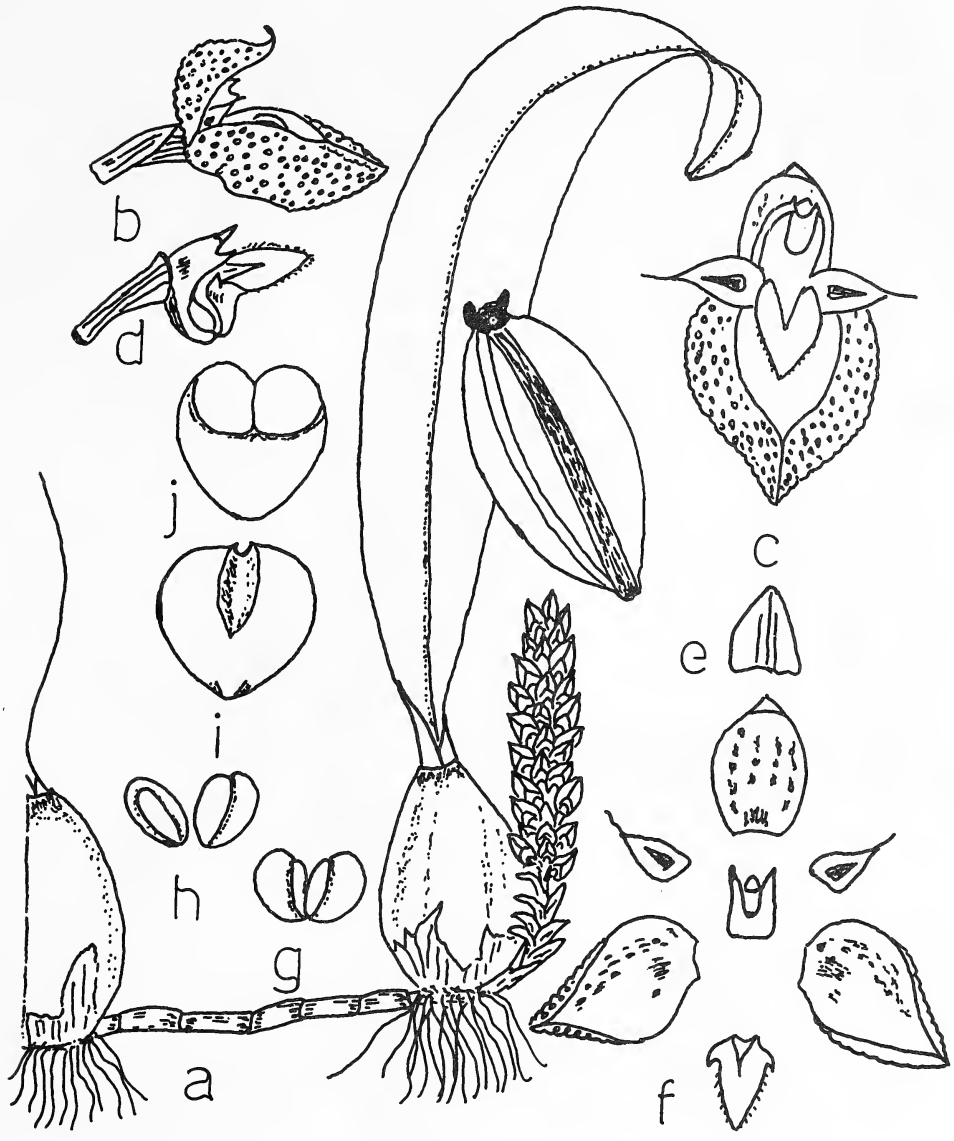

Fig. 2. *Bulbophyllum lilacinum* var. *sorocianum* Ahmed *et al.* var. nov.: (a) habit sketch with inflorescence (x 1/2); (b) flower from side showing bract (x 3); (c) flower from front (x 4); (d) pedicellate ovary, column, foot and lip attached from side (x 4); (e) floral bract (x 3); (f) sepals, petals and lip spreadout, column from inside (x 3); (g) pollinia (x 20); (h) pollinia spreadout (x20); (i) operculum from front (x 20); (j) operculum from inside (x 20); (k) capsule (x 2).

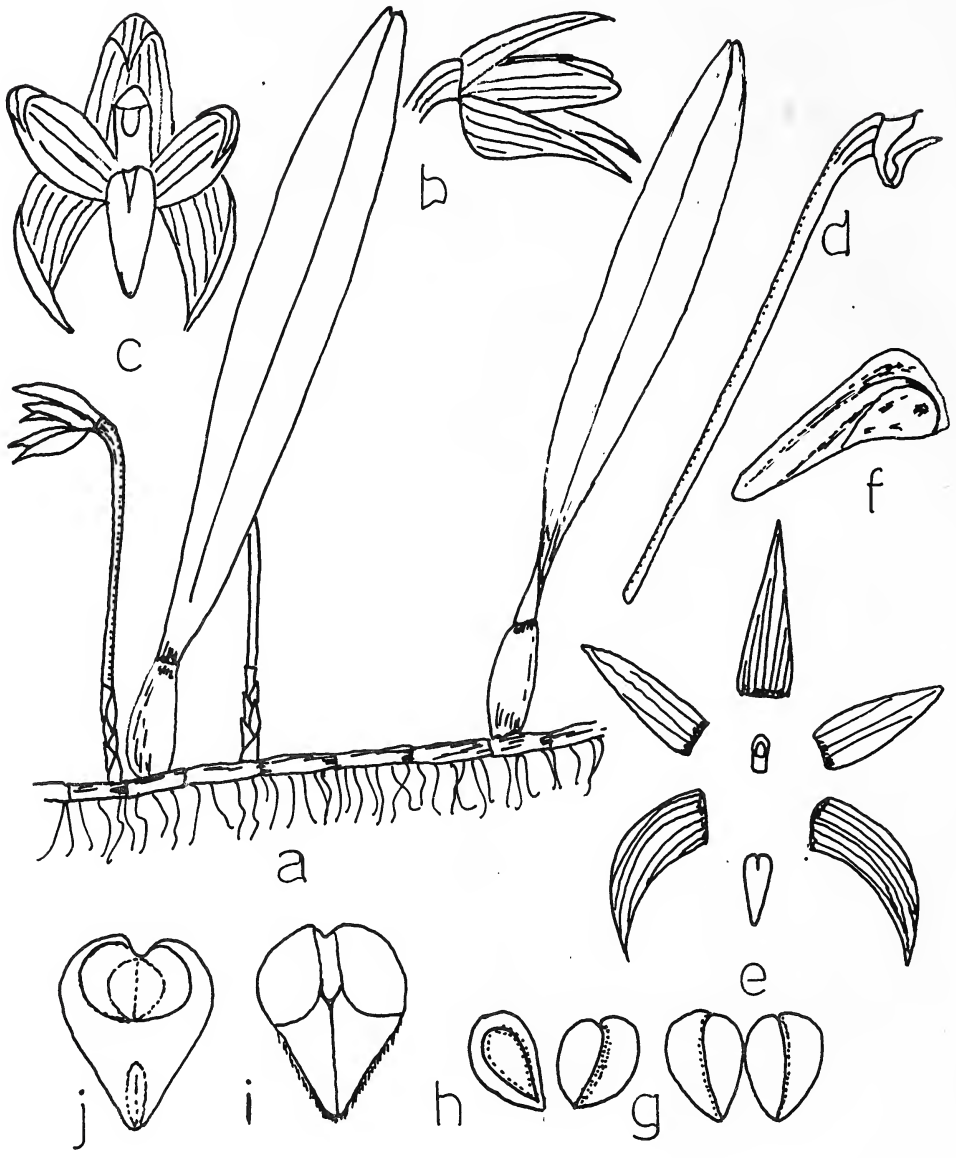

Fig 3. *Bulbophyllum lobbii* Lindl. : (a) habit sketch with scape (x 1/2); (b) flower from side (x 1); (c) flower from front (x 2); (d) pedicellate ovary, column, foot and lip attached (x 1); (e)sepals, petals, lip spreadout , and column from inside (x 1); (f) lip from semi-side (x 3); (g) pollinia (x 10); (h) pollinia spreadout (x 10); (i) operculum from front (x 10); (j) operculum from inside (x 10).

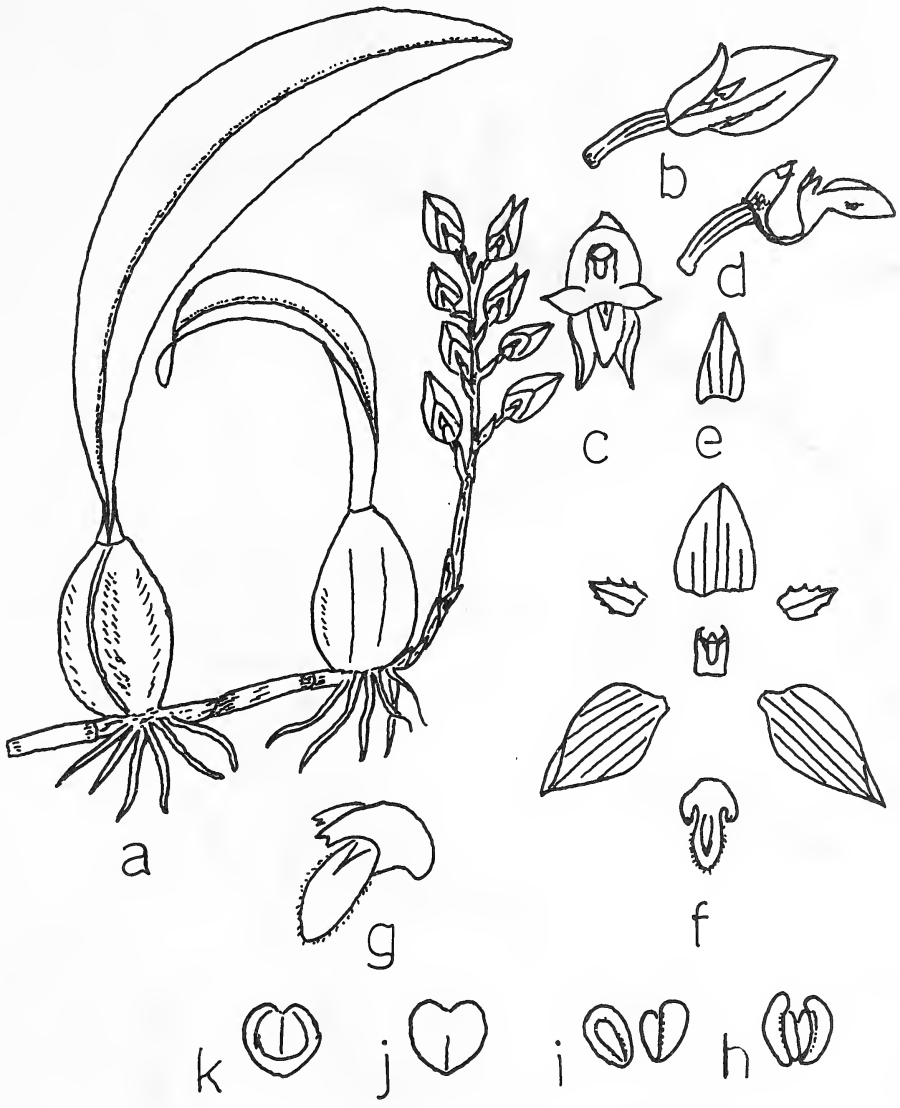

Fig 4. *Bulbophyllum neilgherrense* Wight: (a) habit sketch with inflorescence (x 1); (b) flower from side (x 2); (c) flower from front (x 2); (d) pedicellate ovary, column and lip attached from side (x 2); (e) floral bract (x 2); (f) sepals, petals, lip spreadout, and column from inside (x 2); (g) lip from semi side (x 5) ; (h) pollinia (x 10); (i) pollinia spreadout (x 10); (j) operculum from front (x 10); (k) operculum from inside (x 10).

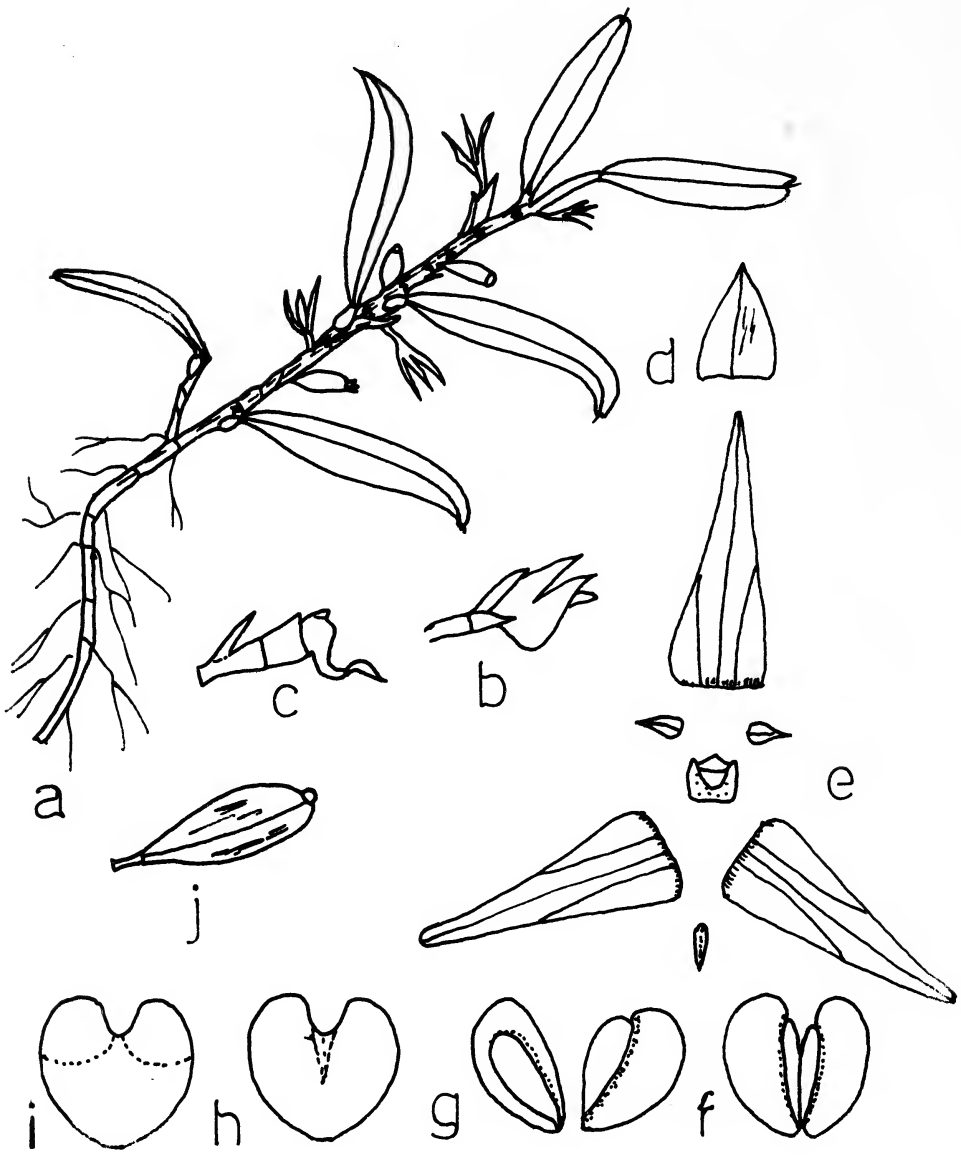

Fig 5. *Bulbophyllum sessile* (Koen.) J.J.S.: (a) habit sketch (x 1); (b) flower from side (x 2); (c) pedicellate ovary, column, foot and lip attached from side (x 5); (d) floral bract (x 5); (e) sepals, petals, lip spreadout, and column from inside (x6); (f) pollinia (x 40); (g) pollinia spreadout (x 40): (h) operculum from front (x 40); (i) operculum from inside (x 40); (j) capsule (x 4).

serving as agents for pollination. They also described the subobliquely ovate- triangular entire petals. but we did not see this character, instead the petal margin was denticulate. According to Pradhan (1979) petals are minute, scaly and ovate-sub-denticulate. On the other hand, Singh (1981) reported that the species as being used as mother plant for many new intergeneric hybrids in foreign countries. Our specimen closely matches with Santapau and Kapadia's (1966) description including the smell of " rotten meat" and the rare flowers under cultivation. These features were also observed in the Orchidarium of Chittagong University,Chittagong, Bangladesh. It is probably the only species which has a foul odour among the Orchids of Bangladesh.

Flowering scape initiation: early November; **Flowering time:** Late November - mid December; **Fruiting time:**Unknown

Geographical distribution: Malabar (India) and Bangladesh.

Specimen examined: Cox's Bazar district: Ukhia, Koto Palong, 20.12. 1986, Mokter 72.

5. **B. sessile** (Koen.) J.J.S., Fl. Buit. 6: 44, f. 340 (1905): Holttum, Fl. Malaya, 1: 451 (1964). Syn. *Epidendrum sessile* Koen., Retz. Obs., 6: 60 (1791); *Bulbophyllum clandestinum* Lindl., Bot. Reg., 27: Misc. 77(1841); Hook. f. Fl. Brit. Ind., 5: 753 (1890); Grant, Orch. Burma, 35 (1895). (Fig. 5)

In Malaya, it is locally abundant as an epiphyte on old fruit trees in rather open places (Holttum 1964). But in this country, it is common as an epiphyte on old trees in deep forest only. The plant is small and pendulous, and difficult to see as it grows on the upper branches, as well as mimic the host plant's colour. Sometimes it grows in aggregated and conspicuous forms, when it is easily seen. **Flowering scape initiation:** Mid August; **Flowering time:** Early September - mid September; **Fruiting time:** September onwards. Flowering considerably varied from early September to mid September.

Geographical distribution: Widely distributed in Indonesia, northwards to Tenesserim, Malaya and Bangladesh.

Specimens examined: Cox's Bazar district: Ukhia, 12.10.1986, Mokter 25; Ramu, Konia Palong, 13.10.1986, Mokter 48; Ramu, Eidghor Reserve Forest, 12.1. 1990, Mokter 150.

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SPECIES RICHNESS OF FERNS AND ASSOCIATED INSECTS FROM DARJEELING PLAINS[1]

A. MUKHOPADHYAY AND D. THAPA[2]

Key words: insects on ferns, Darjeeling plains

A survey in the Darjeeling plains revealed some eighteen species of ferns, of which, five were common. Insects found associated with the common ferns were mostly Hemiptera (20 spp.) and Coleoptera (19 spp.) followed by the Lepidoptera (12 spp.). Two polyphagous species of Orthoptera were recorded on the common ferns, *Diplazium and Christella*. Some microlepidoptera and thysanoptera were found associated with the sporophylls only. Besides a phytophagus species of sawfly, three other Hymenoptera recorded were parasitoids. The sole dipteran fly recorded was a laval-pupal parastite of the herbivorous lepidopteran, *Spilarctia scasigneta* . Some of the fern attacking insects also occur on economically important plants.

INTRODUCTION

Ferns are one of the most primitive plants are generally considered as difficult plants for herbivores to exploit (Eastop 1973, Hendrix 1977, Cooper-Driver 1978). As such, a relative paucity of insect-herbivores association with ferns has been reported (Schneider 1892, Brues 1920, Dethier 1947, Ehrlich and Raven 1964). Swezey (1922) reported an extensive insect fauna of 44 species associated with the fern flora of Hawaiian Islands. However, only one fourth of the insect species reported were actually phytophagous (Weiczorek 1973). This underutilization of ferns by insects has been attributed to host-resistant factors (Swain and Cooper-driver 1973, Huffaker 1974, Hendrix 1977, Balick *et al.* 1978, Daniel and Chandrasekar 1986). However, the extensively sampled fern *Pteridium aquilinum* (L) Kuhn, is known to support a fair population of insect fauna (Lawton 1976, strong and Levin 1979). Further a pioneering quantitative study by Balick *et al.* (1978), showed that three Mexican ferns were also extensively exploited by insects.

The phytogeographic area of Darjeeling plains has a heterogenous vegetation. The forest, agroecosystem, tea gardens are either flanked by or interspersed with fern vegetation. It is likely that some of the fern associated insects may switch over to such economically important vegetation. On the other hand, the possibility of the adjacent fern flora harbouring the natural enemies of the crop-pests also cannot be overlooked. Therefore with an eye to the nature of contribution that the fern vegetation makes through insect-fern-crop interaction and also to examine the hitherto unknown insect faunal community of common ferns the present investigation was undertaken.

MATERIALS AND METHODS

A monthly survey was done during 1988-90 at different sites, and the fronds were randomly sampled. The insects associated with the fronds of the common ferns were either hand picked or collected with the help of an aspirator. They were later etherised and oven dried before preservation for identification. The spotulating fronds were collected and brought to the laboratory where they were poisoned and pressed for herbarium preparation.

In case of the insect eggs and larvae, the ferns on which they were found were supplied as food to rear them to the adult stage. The ferns as well as the insect materials were identified by the Botanical Survey of India, Zoological Survey of India and by other competent authorities.

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Observations and Results

The survey of fern flora and the associated insects of the common ferns was conducted extensively in the Darjeeling plains that was delimited by river Teesta in the east and river Mechi in the West. The ferns sofar recorded are listed in Table 1. Of these the commonly found ferns belong to the genera *Diplazium, Christella, Lindsea* and *Microlepia*.The insects associated with these common ferns were specially considered and identified to understand their role in the insect-fern-crop relationship. Of these groups of ferns, *Diplazium* had the largest number of insect herbivores, followed by *Christella* and *Microlepia* (Table 2). *Lindsea* was abundant but no insect, attacking this fern, could be recorded. Some specialized feeders like some microlepidoptera were found to exploit the spores and sporangiophores of *Christella* and *Diplazium*. Most of the lepidoptera larvae, including the economically important species, used maturing fronds as food. *Psara ustulalis*, however, had the peculiarity of rolling the apex of the mature fronds to make its own nest, where it ultimately pupated. While almost all the immature stages of the polygphagous species, *Spilarctia casigneta* was commonly recorded on *Diplazium*, natural occurrence of *S. obliqua* was more sporadic on the same host plant.

Of the commonly occurring beetles, worth mentioning was the green weevil, *Astycus lateralis*, which nibbled the maturing fronds and were also known to attack tea. Another polyphagous weevil, *Myllocerus disolour*, was common and had the potentiality to attach a number of crops (Table 3).

Colonies of two species of aphids belonging to different genera were restricted to the ventral side of the young and maturing fronds of *Diplazium*. Two distinct species of mirids were found to be more associated with *Christella* than with *Diplazium*, and unlike most other insects they attached the young coiled fronds. Amongst the hymenopterans found associated as a true herbivore, a species of sawfly, *Stromboceros congener*, needs special mention. All the larval stages of the species used maturing fronds of *Diplazium* and *Christella* as their food. Pupation took place in soil. The larvae of the species of thrips (mentioned in Table 2) were found associated with the sporophylls of *Diplazium*

The natural enemies of the fern insects were mainly parasitoids. The brachonid parasitoids were recorded from the larvae, while the chalcids were recorded from the eggs of *S. casigneta*. The larvae of *S. casigneta* were found to be attacked by larval-pupal parasitoids. These were the uzi flies possibly belonging to the genus *Exorista*. The larvae of these lepidopterans when reared indoor were also affected by a fair infestation of these tachynid flies. The heteropteran bug, *Eusarcocoris ventralis*, was found to attack the lepidopteran larvae of *P. ustulalis*.

Discussions

The list of fern flora and its associated insect fauna is based on survey work using the methods of random sampling at spots selected across the entire stretch of the Darjeeling plains. Although utmost care had been taken torecord the available species of ferns and the insects associated mostly with the common ferns, yet the list may not be complete. The chances of finding new fern species and their associated insect forms can not be ruled out in the elephant infested stretch of Terai woodlands and amongst the epiphytic ferns. Moreover, some of the insect species occurring for very short periods and also those which are facultative fern-feeders, might have gone unnoticed.

Examination of the British fern-feeding insects (Ottosson and Anderson 1983) and comparison with a more comprehensive list by Hendrix (1980) revealed that the present list of the fern-associated insects of Darjeeling plains had most of the orders in common excepting for Collembola and the phytophagous Diptera. The finding of thysanoptera from the fern fauna of Nilgiri and Annamalai hills by Daniel and Chandrasekar (1986) was corroborated by the present observation from this part of India, when the association of thrips were also recorded with the

TABLE 1
A LIST OF FERNS FROM DARJEELING PLAINS

1. *Blechnum orientale* Linn.
2. *Christella appendiculate* (Pr.) Holt.
3. *Christella aridus* (Holt).*
4. *Christella crinipes* (HK) Holt.*
5. *Christella parasiticus* (L) Lev.
6. *Cyathea spinulosa* Wall Hook. (Tree Fern)
7. *Diplazium esculentum* (Retg) Sw.*
8. *Dicranopteris linearis* (Brum. f.) underus.*
9. *Lindsea ensifolia* Sw.*
10. *Lygodium flexuosum* (L) Sw.
11. *Macrothelypteris torresiane* (Gaud) Ching
12. *Microlepia speluncae* (L) Moore*
13. *Onichium siliculosum* (Desv.) C. Chn.
14. *Pityrogramma calomelanos* (Linn.) Linx.
15. *Pteris semipinnate* Linn.
16. *Pteris laiaurita* Linn.
17. *Pteris vittata* Linn.
18. *Lypteris* sp.

* Commonly occurring fern species.

TABLE 2
A SPECIES LIST OF INSECTS ASSOCIATED WITH FERNS FROM DARJEELING PLAINS

Insect name and Order	Family
LEPIDOPTERA	
1. *Callopistria placododoides* (Guen)	Noctuidae
2. *Prodenia litura* (Fabr)	"
3. *Spodoptera mauritia* (Boisd)	"
4. *Eriopus* sp.	"
5. *Spilarctia casigneta* (koll.)	Arctiidae
6. *Spilarctia obliqua* (Walak.)	"
7. *Spilosoma* sp.	"
8. *Diacrisia punctata* (Moore)	"
9. *Nacoleia vulgalis* (Hampson)	Pyralidae
10. *Psara ustulalis* (Hampson)	"
11. *Amata cyssea* (Cramer)	Ctenuchidae
12. Microlepidopteran sp. (indet)	
COLEOPTERA	
1. *Anthicus* sp.	Anthicidae
2. *Aphaniptera* sp.	Buprestidae
3. *Chrysolina inconstans* Wied	Chrysomelidae
4. *Aspidomorpha dorsata* (F.)	"
5. *Aspidomorpha* nr. *indica* Boh.	"
6. *Aspidomorpha sanctaecrueis* (F.)	"
7. *Hoplasoma unicolour* (Iu.)	"
8. *Manobia* sp.	"
9. *Monolepta* sp.	"
10. *Altica* sp.	"
11. *Afissa dumeili* (Muls.)	Coccinellidae
12. *Cryptogonous* sp.	"
13. *Nanophyes* sp.	Curculionidae
14. *Alcides* sp.	"
15. *Astycus lateralis* (F.)	"
16. *Myllocerus discolour* (Boh)	"
17. *Phytoscaphus* sp.	"
18. *Legria* sp.	Lagridae
19. Species (indet)	Elateridae
HEMIPTERA	
1. *Macromyzus* sp.	Aphididae
2. *Tinocallis* sp.	"
3. *Clovia conifera* (Walk)	Cercopidae
4. *Typhlocyba* sp.	Cicadellidae
5. *Bathrogonia ferruginea* Fabr.	"
6. *Penthimia juno* Dist.	"
7. *Gargara robusta* (Dist.)	Membracidae
8. *Homoeocerus* sp.	Coreidae
9. *Cletus bipunctatus* Westw.	"
10. *Leptocorisa acuta* (Thunb.)	"
11. *Graptostethus trisignatus* Dist.	Lygaeidae
12. *Spilostethus pandurus* (Fabr)	"
13. *Agonoscelis nubila* Fabr.	Pentatomidae
14. *Erthesina guttata* (Fabr)	"
15. *Eusarcocoris ventralis* Westw.	"
16. *Dysdercus koenigii* (Fabr)	Pyrrhocoridae
17. *Iphita limbata* Stal.	"
18. *Chrysocoris stollii* (Wolff.)	Scutellenidae
19. Species A (indet)	Miridae
20. Species B (Indet)	"
HYMENOPTERA	
1. *Stromboceros congener* knw.	Tenthridinidae
2. *Apanteles* sp.	Braconidae
3. Species A (indet)	Ichneumonidae
4. Species B (indet)	Chalcidae
ORTHOPTERA	
1. *Atractomorpha crenulata* (Fabr.)	Pyrgomorphidae
2. *Phlaeoba panteli* (Bolivar)	Acrididae
THYSANAOPTERA	
1. *Heliothrips haemorrhoidalis* (Bouche)	Thripidae
2. *Elaphrothrips* sp.	Phlaeothripidae
DIPTERA	
1. *Exorista* (?)	Tachynidae

TABLE 3
FERN ASSOCIATED INSECT SPECIES ATTACKING CROPS

[List prepared after Nair (1975), Das (1965), Banerjee and Haque (1985) and local observations]

Order and Insect Name	Alternate Host Plants
LEPIDOPTERA	
Spilarctia casigneta (Koll)	Black gram, sunflower, Sunhemp.
Spilarctia obliqua (Walk)	Jute, sesamum, castor, ladies finger, groundnut, linseed, turmeric, sunflower, sunhemp, potato, sweet potato.
Spodoptera mauritia (Boisd)	Rice, wheat foliage, millets.
HEMIPTERA	
Agonoselis nubila Fabr.	Rice, wheat, millets. pulses, ber, tobacco.
Chrysocoris stollii (Wolff.)	Leechi.
Eusarcocoris ventralis Westw.	Sesamum.
COLEOPTERA	
Astycus lateralis (F.)	Tea, millets, jute, cotton, sunhemp.
Myllocerus discolour (Boh.)	Drumstick, rice, wheat, millet, cotton, groundnut.
ORTHOPTERA	
Atractomorpha crenulata (Fabr.)	Tobacco, sunflower, jute.
THYSANOPTERA	
Heliothrips haemorrhoidalis (Bouche)	Citrus, tea, coffee.

sporophylls of *Diplazium*. However, most of the representative species of the insect-fauna of fern observed in the present survey seemed to be restricted to the Oriental region as they had little in common with the comprehensive list comprising the elements from other parts of the world (Hendrix 1980).

The study of the insect fauna of ferns is also of economic significance, because a number of these species being polyphagous have the potentiality to switch over and cause damage to crop plants. They may also contribute in terms of natural insect enemies, that may keep the crop-pest population under control (Ananthakrishnan *et al.* 1986). It is only after the correct identification that the role of the Uzi flies can be understood. If the flies do not attack silk-worm larvae they may be useful as a natural controlling agent of lepidopteran pests.

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OCCURRENCE OF *LIMNOCNIDA INDICA* ANNANDALE IN THE PANDRI RIVER (WESTERN GHATS, KARNATAKA , INDIA), WITH A NOTE ON FRESHWATER MEDUSAE OF INDIA[1]

NARAYAN RAMAPPA BIRASAL[2]

(With a text-figure)

Key words: Western Ghats, *Limnocnida*, freshwater medusa

The present short communication concerns a medusa which appeared in a pool of Pandri river (a tributary of Kali river in Kalinadi hydroelectric project area, Western Ghats, Uttara Kannada District, Karnataka State, India) and an account of freshwater medusae of India

Though Alcock (1911) had seen medusae in a lake at Purulia (Chota Nagpore) in 1879-80, Annandale (1911) was the first to record freshwater medusa from India and to describe the same as *Limnocnida indica* (Annandale 1919). The history of occurrence of *L. indica* and a few other medusae in Indian waters is given in Tables 1 and 2 respectively. It is noteworthy that freshwater medusae were found in a river system which flows eastwards to enter the Bay of Bengal and westwardly flowing across the continent to enter the Arabian Sea. However, many of the workers opined that the agency responsible for their introduction into the respective localities will remain a matter of speculation until further studies are carried out (Jones 1951, Joshi and Tonapi 1965, Malhotra *et al.* 1976).

The Western Ghats have some peculiarities of its fauna, the most striking being the presence of a marine element, which attracted attention, and more information about one species, *L. indica* is badly needed (Hora 1926). Whether the medusae occur in the pool year after year is worth investigating in view of speculations regarding origin and distribution of *L. indica* (Ramakrishna *et al.* 1950). There is a lone report on the occurrence of *L. indica* in Thunga river (in one and the same pool) in successive years (Iyengar and Venkatesh 1955-56). While carrying out limnological work in the six sampling stations (Fig. 1), I could observe the presence of freshwater medusae, specially during summer months. In summer (March, April, May) of 1985, I could see the presence of medusae in the pool of the Pandri river (A_1), but not in the other five sampling stations.

The Pandri river (perennial inflow) is a tributary of Kali river and at its confluence near Ganeshgudi, is the Supa dam (tallest in Karnataka- height 101 m). To date the Supa reservoir has not reached its maximum level (564 m at FRL). The sampling site A_1 will be submerged, when the reservoir attains its full supply level. The geology, morphometric details of the Supa dam site, water chemistry and zooplankton availability are reported in earlier publications (Birasal *et al*. 1985, 1987,1989). The observations made in the summer season of five years (1986 to 90) and recorded the presence of medusa, *L. indica*.

Though several workers have reported the occurrence of *Limnocnida* in many rivers of India, the life history of the medusa has remained more or less obscure. (i) The reiterated belief that the presence of budding in the life cycle of *L. indica*, so frequently observed in its African relative *L. tanganyikae* (Beadle and Thomas 1957), (ii) speculations made by Annandale (1919) that a resting stage may intervene in the life history and (iii) Agharkar (1913) and Hora's (1926) opinion that one should look carefully for the growth of hydroid on the rocks, were my chief inducements to persue continuous observation for six consecutive

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TABLE 1

OCCURRENCE OF *LIMNOCNIDA INDICA* IN INDIAN WATERS (WESTERN GHATS)

Sl. No.	Name of the river/reservoir/tank	Location	Recorded on	Some salient features of the sampling site	Reference
1	Koyna river (a tributary of Krishna river)	At Tambi	1911	Deep pools	Hora 1926
2	Krishna river	At Dhom	1911	Deep pools	Hora 1926
3	Varna & Panchganga rivers (tributaries of Krishna river)	-	May 1913	-	Rao 1932
4	Yenna (Vena) river (a tributary of Krishna river)	At Medha	April & May 1918	7-12 metres deep, Rocky bottom	Annandale 1919, Hora 1926
5	Periyar lake (formed by damming a west flowing Periyar river)	In Travancore	4.6.34	Lake is situated at an elevation of 3-4 thousand feet	*Darling 1935
6	Pampadampara tank (in the Cardamom Hills, Travancore)	About 20 miles north of Periyar lake	1944	Artificial tank at an altitude of about 3000 feet; 5-8 feet deep; muddy bottom	Jones 1951
7	Sharavathi river	At the bottom pools of Jog falls (a sheer drop of 930 feet)	May 1947	Pool is 175 feet deep; Pool fed by an underground spring	Ramakrishna *et al.* 1950
8	Krishnarajasagar reservoir (on west flowing Cauvery river)	Near Sagarkatte about 7 miles above the dam	27.4.1949	Pool has rocky bed; 5 feet deep	Krishnamurthy 1953
9	Thunga river (west flowing)	Near Arkere 3 miles from Shimoga	26.3.54 to 07.06.54 & on 25.2.55	Pool has sandy bed; 6.5 feet deep	Iyengar & Venkatesh 1955-56

* Her Provisional identification of the medusa stopped with the genus (species identification needs proper examination of the collection.

TABLE 2
OCCURRENCE OF FRESHWATER MEDUSAE IN INDIAN WATERS

Sl. No.	Name of the species	Location	Recorded on	Peculiarities of the specimen	Reference
1	*Moerisia gangetica*	Shambazar Khal, Dakhnidar, Near Calcutta(Gangetic water system)	13.05.1926 (only one specimen)	a. Spherical shaped umbrella (3 mm in diameter & 2 mm in height) b. Manubrium-quadrangular c. One gonad encircling the manubrium d. 19 marginal tentacles (all of about same size) e. Each tentacle has a short, semiglobular basal bulb.	Kramp 1958
2	*Craspedacusta sowerbyi*	Experimental aquarium tank of Zoology Deparment of Poona University	18.08.1962 (about 20 specimens appeared within two weeks)	a. Bell shaped umbrella (0.4 mm in diameter & 0.3 mm in height) b. Gonads not noticed (slight thickenings in the vicinity of radial canal in some specimens is significant) c. 8 cylindrical, solid tentacles having 0.2 mm in lngth (all of about the sam size).	Joshi & Tonapi 1965
3	*Mansariella lacustris* (Generic name after the name of the lake and species name after the nature of the lake)	Mansar lake, Jammu (sub-tropical, isolated, springfed freshwater lake situated at a height of 700 m AMSL)	September & October (in large numbers)	a. Medusae are umbrella shaped (maximum diameter 15 mm) b. No gonads (young medusoid forms appear to bud-off from gastric region of the bigger forms) c. Nearly 160 tentacles measuring 20 mm in length arranged in a single row d. Base of tentacle is swollen with a statocyst e. Tentacles do not show any terminal sucker or adhesive pad f. Mouth is circular (15 mm in diameter).	Malhotra et al. 1976
4	*Keralica idukkensis* (Generic name after the state and species name after the reservoir)	Idukki reservoir (Hydroelectric project, Kerala)	1983 (collected throughout monsoon, post-monsoon & in early months of pre-monsoon)	a. Gonads are slightly visible as small thickenings on radial canals in young forms b. 128 solid tentacles measuring upto 2 mm in length (all of about same size) originating from circular canal, arranged in a single row c. Beaded appearance of base of tentacle due to presence of statocyst d. Tentacles do not have terminal sucker or adhesive pad e. Mouth is circular (1 mm in diameter); when open lips are arranged radially forming 6-lobed structure.	Khatri 1984

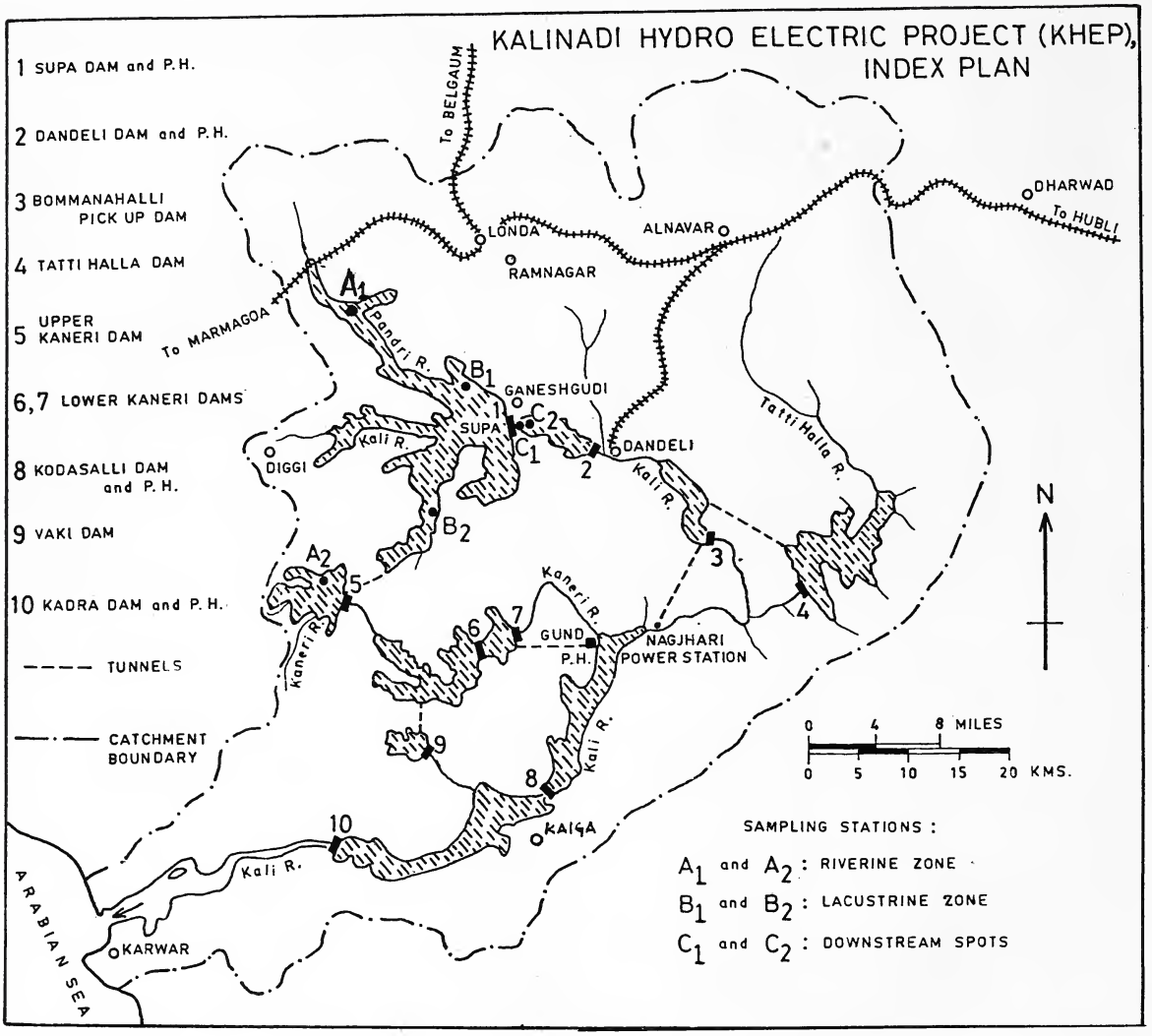

Fig. 1. Location of the sampling stations in KHEP area.

summer seasons (i.e. 1985-1990). During none of these visits was I able to see on the stone/rocks any organism which could be the hydroid stage of *L. indica*. The most probable explanation seems to be that the hydrozoan remains for the greater part of the year in an encysted condition and the medusa becomes fully developed under favourable conditions during the summer season.

The genus *Limnocnida* hitherto recorded has been reported from many parts of India (Table 1) and Africa (Beadle 1981, Dumont and Verheye 1984, Green 1960, Kramp 1954). The presence of the freshwater medusa in the Pandri river extends its distribution to the western side of the Sahyadris. The medusa in all probability has a wider distribution than hitherto recorded both on the eastern as well as

western drainages of peninsular India. As to the occurrence of this medusa of unquestionable marine origin in the rivers/lakes of the two great continents of Africa and India, there is possibly one explanation, namely the ancestors of *Limnocnida* have passively migrated from an ancient sea, parts of which were cut-off from the ocean (as the result of seismic disturbances) and acclimatised themselves to incidental changes of an inland sea into freshwater areas. Occurrence of *Limnocnida* in Africa and India provides an instance of the sort of discontinuous distribution that might lend support to the view of the existence of a former land connection between Africa and peninsular India.

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FOOD OF THE ROSE-RINGED PARAKEET *PSITTACULA KRAMERI: A* QUANTITATIVE STUDY[1]

HARJEET K. SAINI, MANJIT S. DHINDSA AND H.S. TOOR[2]

(With two text-figures)

Key words: feeding ecology, *Psittacula krameri*, diet diversity, food-niche breadth

Gut contents of the Rose-ringed Parakeet *Psittacula krameri* (Scopoli) were analysed gravimetrically during August 1988 to July 1989 in an intensively cultivated area of Punjab. Cereals (45% of total contents) and tree seeds (38%) were the predominant food of the species. Among cereals, sorghum (21%) was the most abundant. Guava ranked first among tree seeds forming 24% of thee diet followed by mulberry (about 10%). Oilseeds formed about 9% and weed seeds nearly 3 % of the contents. Pearl millet, sorghum and maize were consumed in significant proportions during August to December. Guava seeds were recorded in large proportions from January to March and July to August. Mulberry seeds formed the main bulk of the food in April and May. Weed seeds belonging to five taxa were recorded from April to June, August, October and February. Food of the Rose-ringed Parakeet was more diverse from August to October and January to March than during rest of the year. Shannon-Wiener index, equitability and Levins' index of the food-niche breadth were calculated to be 1.02, 0.80 and 0.33, respectively.

INTRODUCTION

The Rose-ringed Parakeet *Psittacula krameri* (Scopoli) is the most widespread species among the parrots of the world (Grzimek 1972). Distributed in Africa, Afghanistan, Pakistan, India, Nepal, Myanmar and Sri Lanka, this species has invaded Mauritius, Zanzibar Island, England, U.S.A., Saudi Arabia, Israel and Germany through man-made and/or natural introductions (Long 1981, Dvir 1988, Lantermann 1989, Stagg 1989). In India, Rose-ringed Parakeet has been rated as the number one bird pest of agriculture and horticulture (Ali and Ripley 1983, Babu and Muthukrishnan 1987). In Punjab, the most intensively cultivated state of India, it inflicts heavy damage to maize, sunflower, mustard, guava, almonds, peach and so on (Ramzan and Toor 1972, 1973, Simwat and Sidhu 1973, Toor and Ramzan 1974, Toor and Sandhu 1981, Sandhu and Dhindsa 1982, Dhindsa *et al.* 1992), and thus warrants control. In Bangladesh also, this species is considered to be the major pest of maize and sunflower (Sultana and Brooks 1986). In Africa, it has been reported to damage sorghum (Cunningham-Van Someren 1969) and in Mauritius it is stated to be a destructive bird pest (Benedict 1957).

Despite the widespread distribution and pest status of the Rose-ringed Parakeet, little information is available on its food and feeding behaviour. Ali and Ripley (1983) have mentioned fruits, cereals and seeds of all kinds of wild and cultivated plants as the food of this species. Although qualitative information on its food is available from Punjab (Simwat and Sidhu 1973, Toor and Ramzan 1974) and Andhra Pradesh (Shivanarayan 1982), there has been no serious study providing quantitative data from any part of India. This paper presents a detailed quantitative description of the diet, seasonal variation in the relative proportion of various food types and the food-niche breadth of this species.

MATERIAL AND METHODS

The study was conducted in the field area of the Punjab Agricultural University, Ludhiana (30° 56' N, 75°52'E, *c.* 247 m above the m.s.l.) from August 1988 to July 1989. The study area is intensively cultivated with two main crop seasons: *rabi* (October-November to April-May) and *kharif* (June-August to September-October). The major *kharif*

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crops are rice, maize and pearl millet, and *rabi* crops are wheat and mustard. The climate of the study area is of semi-arid monsoon type. Generally, four seasons are experienced in a year: summer or pre-monsoon season (April to June), monsoon (July to September), post-monsoon (October to November) and winter (December to March).

In total, 88 birds were collected using a 0.22 airgun. Monthly sample sizes ranged from 5 to 11 except in December when only two parakeets could be collected. Soon after collection, the birds were dissected and the guts (esophagus and gizzard) opened to extract contents. The contents were washed through a nylon sieve and dried on blotting papers at room temperature. They were then sorted and weighed on an electric balance to the nearest of 0.001 g. Monthly summaries of the relative proportions by weight of various food types were prepared.

Three indices were used to study the food-niche breadth (Krebs 1989): Shannon-Wiener index (H'), equitability (J') and Levins' index (B). These indices were calculated as follows:

$H' = - \Sigma$ pi log pi,

where, pi is the proportion of the ith food type in the diet;

$J' = H'/H'$ max,

where, H' max is the log of total number of food types recorded in the guts; and

$B = 1/\Sigma pi^2$.

Levins' index was standardized to express it on a scale of 0 to 1.0 following Hurlbert (1978) as:

$$B_A = (B - 1)/(n-1)$$

where, B_A is Levins' standardized niche breadth, and n is the number of food types recorded.

Results

Diet Composition: Gravimetric analysis of gut contents of 88 Rose-ringed Parakeets revealed cereals and tree seeds as their predominant food comprising 45% and 38% of the total contents, respectively (Table 1). Oilseeds (mustard, sunflower and groundnut) accounted for about 9% and weed seeds nearly 3% of the total diet. Gram, recorded in only three of 88 guts dissected, made only 2% of the total contents. Unidentified vegetative matter, consisting of crushed leaves and seed husks, formed about 2% of the diet. Grit was recorded in 14% of the guts analysed and formed 1 % of the total intake.

Among cereals, sorghum was the predominant food making about 21% of the diet and was recorded in 15% of the guts analysed (Table 1). Pearl millet, maize and wheat each constituted 6-7% of the diet and was recorded in 7-15% of the guts analysed. Rice was consumed in very low proportions and formed only 4% of the total diet.

Among tree seeds, those of guava were predominant as they alone accounted for nearly 24% of the diet. Following guava were seeds of mulberry (10%) and sissoo (4%). Seeds of siris and dek were recorded in relatively very small proportions. Weed seeds of five taxa formed only 2.8% of the diet, of which *Crotalaria medicaginea* accounted for more than 2%.

The values of three indices of food-niche breadth *viz.*, Shannon-Wiener index, equitability and Levins' standardized index were calculated to be 1.02, 0.80 and 0.33, respectively.

Seasonal changes in the diet: Sorghum was recorded in significant amounts in the guts of the Rose-ringed Parakeet from August to January. Its proportion in the diet increased steadily from less than 10% in August to 76% in December and declined rapidly to 18% in January (Fig.1). Relative proportion of pearl millet exceeded that of any other cereal in August (22%) and September (40%), whereas in two other months when recorded, it only supplemented the diet. Maize constituted considerable proportion (16-23%) of the diet from September to November. It was also recorded in four other months but only in small proportions (<5%). Among the other cereals recorded in the guts of parakeets, rice in January (25%) and wheat in March (20%) and July (51%) were predominant (Fig.1). Among oilseeds, groundnut in February

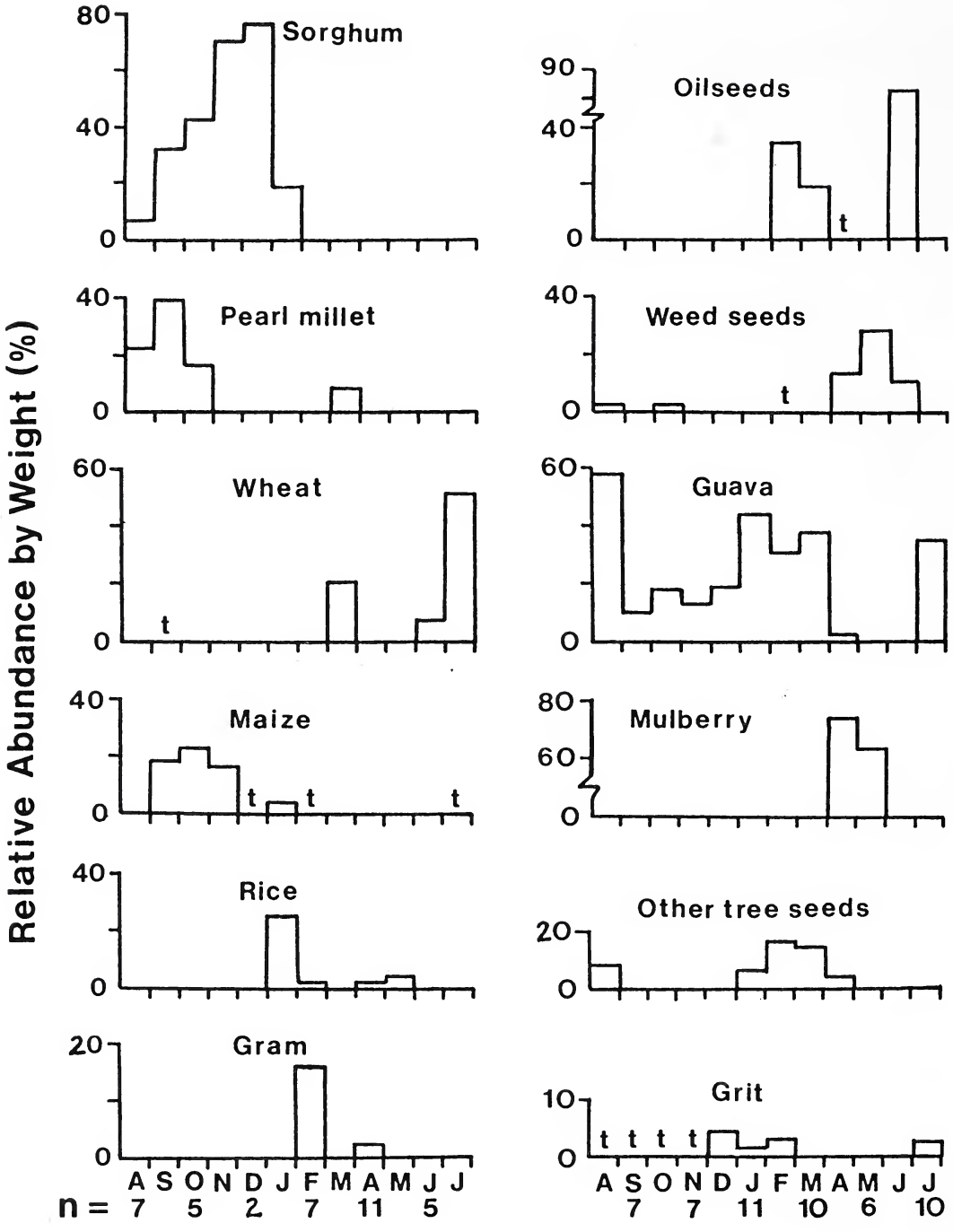

Fig. 1. Seasonal variations in the food of the Rose-ringed Parakeet during August 1988 to July 1989 (t = traces, i.e. <1%). Figures below months along X-axis indicate sample sizes.

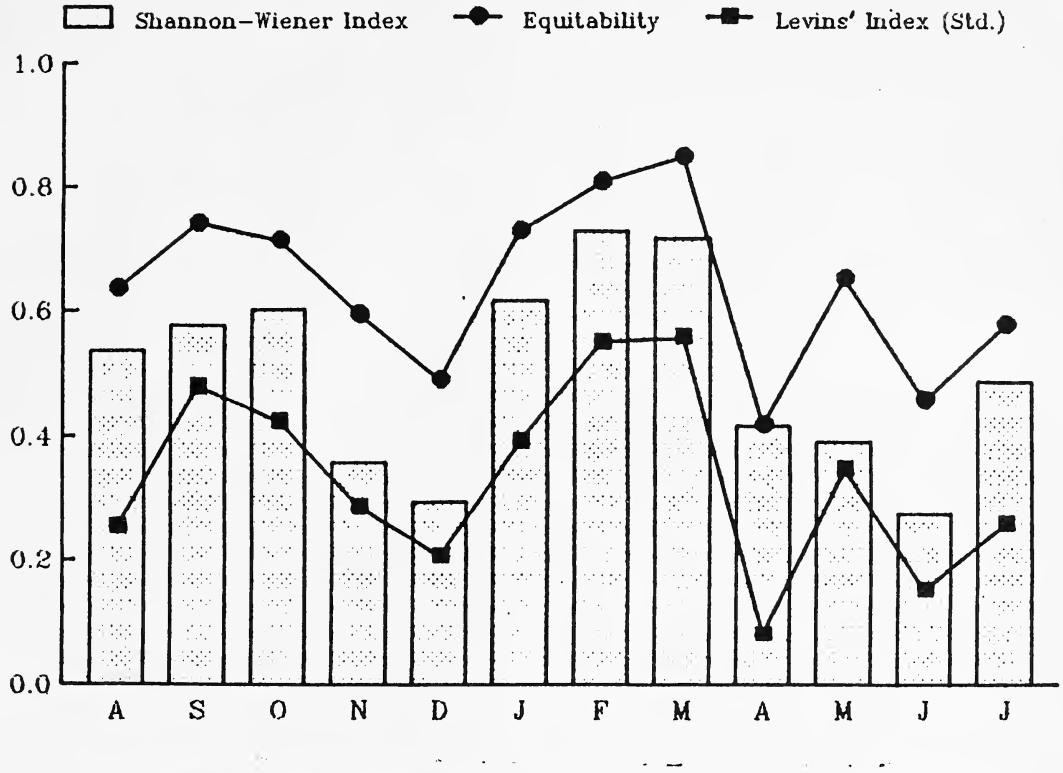

Fig.2. Seasonal variations in three indices of food-niche breadth of the Rose-ringed Parakeet during August 1988 to July 1989.

(17%), mustard both in February (17%) and March (18%), and sunflower in June (82%) formed a significant proportion of the diet.

The occurrence of guava seeds was more prevalent in the diet than any other tree seed as these were recorded in the guts in variable proportions throughout the year except in May and June (Fig.1). Guava seeds dominated the diet in August (58%) and also from January to March (30-45%). In July, this food type ranked second in abundance after wheat. From September to December, guava seeds accounted for 10-20% of the total food. Mulberry seeds formed the major food of parakeets in April and May, constituting 64-75% of the total food. Among other tree seeds, those of sissoo formed about 16% of the diet in February, whereas, in four other months they formed less than 10% of the food. Siris seeds were recorded in the diet only in March (12%) and dek seeds only in April (<1%).

Weed seeds formed considerable proportion (9-28%) of the diet only from April to June. Seeds of *Crotolaria medicaginea* were abundant in the diet in April and May and those of *Rumex* spp. in August and June. Other weed seed, recorded in very small proportions (<1%), were of *Trigonella polycerata, T. foenum-graecum* and *Melilotus alba.* Vegetative matter that could not be identified ranged from <1 to 4% of the diet in six months of the study. The proportion of this matter, however, was about 10% in July. Grit was recorded in eight months of the study constituting <1% of the total intake in August to November and 2-5% in December, January, March and June.

Seasonal Variations in Food-Niche Breadth: Seasonal variations in the three indices of food-niche breadth (Fig. 2) revealed that the food of parakeets was more diverse from August to October and January to March. The maximum values of Levins' standardized index (0.56) and equitability (0.85) were recorded in March, while that of food diversity (0.73) was in February. Similarly, minimum values of Levins' index (0.8) and equitability (0.42) were recorded in April and that of food diversity (0.28) in June.

Discussion

Based on the relative proportions of different food types recorded in this study, guava seeds were the predominant food of the Rose-ringed Parakeet. Interestingly, the pulp of guava fruits was not recorded in any of the guts analysed, suggesting that parakeets ate only the seeds. To test this, guava fruits were provided to two caged parakeets. These birds consumed only the seeds. To expose seeds, the whole pulp was cut into small pieces and discarded. The seeds were crushed with powerful bills as evidenced by the sound of cracking seeds that could be heard at a distance of 3 m. Guava seeds recovered from the guts were very well masticated. In Punjab and Uttar Pradesh, Rose-ringed Parakeet is reported to cause 20-30% damage to guava (Ramzan and Toor 1972, Singh and Kumar 1982). The Rose-ringed Parakeet has often been termed a frugivorous bird but our study suggests that this species does not feed on guava fruits but on their seeds. In case of almonds also, parakeets have been reported to break the fruit to extract and eat their kernels, leaving the hull and stone portions attached to the plants (Sandhu and Dhindsa 1982). The fruits of peach, however, are damaged differently. Parakeets eat the pulp of ripening peach fruits but do not break the seeds (Toor and Sandhu 1981), probably because they are very hard. For other fruits, it remains to be seen whether parakeets eat the succulent parts (as in peach) or damage them to expose and eat their seeds (as in guava). Nevertheless, the fruits are damaged.

Sorghum, cultivated for fodder purpose in much of Punjab, was the second abundant food type recorded in the guts. It was the most preferred one among the cereals. Wheat and rice, the two major cereal crops of Punjab, constituted only 3-6% of the diet. Simwat and Sidhu (1973) mentioned the presence of sorghum in parakeet diet but without any quantification. Shivanarayan (1982) reported rice and sorghum as the most preferred cereals eaten by parakeets in Andhra Pradesh but quantitative data were lacking. In laboratory experiments, we studied preferences of captive parakeets for sorghum and two other *kharif* cereals *viz.*, rice and maize (Saini and Dhindsa 1993). Parakeets preferred sorghum over the other two cereals in these experiments. Sorghum, therefore, may be used as a lure or trap crop for reducing parakeet damage to maize.

Guava seeds were recorded in the guts throughout the year except in May and June. However, relatively high proportions of this food type (>30%) occurred in the diet during January to March and July to August which coincided with the two main fruiting seasons of this crop. During this period ripe guava fruits are abundant and probably it is easier for parakeets to extract seeds from ripe fruits. In May and June, however, parakeets preferred to feed on mulberry, sunflower and *Crotalaria medicaginea* rather than on guava seeds. This may be because of energy requirement reasons; apparently less energy is needed to collect mulberry and sunflower as compared to extracting seeds from unripe guava fruits. From August to December pearl millet, sorghum and maize formed significant proportion of the diet. Pearl millet and sorghum are raised as fodder crops in the study area, hence the damage to their earheads is of little concern. Maize, however, suffers heavy damage (12-21%) from parakeets (Ramzan and Toor 1973, Simwat and Sidhu 1973). From January to June, cereals formed only small proportions of the diet except for rice in January and wheat in March. Wheat and rice were not recorded in the guts of parakeets during April-May and October-November, respectively, the

TABLE 1

OCCURRENCE AND RELATIVE ABUNDANCE OF DIFFERENT FOOD TYPES IN THE GUT CONTENTS OF THE ROSE-RINGED PARAKEET (N=88) FROM AUGUST 1988 TO JULY 1989

Food Type	Occurrence in guts		Relative abundance
	Frequency	%	(% by dry weight)
CEREALS			
Sorghum *Sorghum vulgare*	13	14.8	20.8
Pearl millet *Pennisetum typhoides*	6	6.8	7.4
Maize *Zea mays*	13	14.8	6.5
Wheat *Triticum aestivum*	11	12.5	6.4
Rice *Oryza sativa*	7	8.0	3.6
Total cereals			44.7
OILSEEDS			
Mustard *Brassica campestris*	9	10.2	3.8
Sunflower *Helianthus annuus*	2	2.3	2.9
Groundnut *Arachis hypogaea*	1	1.1	2.4
Total oilseeds			9.1
PULSE			
Gram *Cicer aeriatinum*	3	3.4	2.4
TREE SEEDS			
Guava *Psidium guajava*	58	65.9	23.6
Mulberry *Morus alba*	17	19.3	9.9
Sissoo *Dalbergia sissoo*	10	11.4	3.8
Siris *Albizzia lebbek*	2	2.3	0.9
Dek *Melia azedarach*	1	1.1	<0.1
Total trees seeds			38.2
WEED SEEDS			
Crotolaria medicaginea	5	5.7	2.3
Rumex spp.	2	2.3	0.4
Trigonella polycerata	1	1.1	0.1
Melilotus alba	1	1.1	<0.1
Trigonella foenum-graecum	1	1.1	<0.1
Total weed seeds			2.8
UNIDENTIFIED VEGETATIVE MATTER	21	23.9	1.7
Grit	12	13.6	1.0

periods during which these crops in maturing stage are abundantly available in the fields. This indicated that wheat and rice are not the preferred foods of parakeets. In January, rice was most probably consumed from grain stores because it is not available in the fields during this month. Parakeets, along with sparrows, doves, pigeons, mynas, etc. congregate at grain stores and rice-shelling yards during December-March and feed on stored paddy (Sandhu and Toor 1984).

Oilseeds (mustard, sunflower and groundnut) formed a considerable proportion of the diet in February, March and June. Parakeets have been reported to cause extensive damage (63%) to mustard (Simwat and Sidhu 1973) during this period. From April to June parakeets subsisted on seeds of native trees (mainly mulberry) and weed seeds of *Crotolaria medicaginea* despite the presence of maturing wheat in the fields. Sunflower crop, which has recently been introduced for oilseed production, matures during May-June and provides a feast for parakeets. In spite of intensive manual scaring, this crop suffers heavy damage from this species (Toor and Ramzan 1974). In small unattended crops damage may range from 90 to 100% (unpublished data). The maturity of this crop and the lean-food period of parakeets are so well matched that its protection has become very difficult. Sunflower seeds, however, were recorded in only two guts of parakeets analysed in this study and formed 3% of the total contents. This may be because of the small sample sizes in May and June.

The food of parakeets was more diverse during August-October and January-March than during rest of the year. The low diet diversity, equitability and food-niche breadth during November-December were probably because of the overdominance of sorghum in the gut contents. The low values of these indices in April-June resulted from the preponderance of tree seeds. In another study, low diet diversity of the House Sparrow *Passer domesticus* was recorded in September-October and January-February owing to the predominance of pearl millet in the former and wheat in the latter period (Saini and Dhindsa 1991).

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NEW DESCRIPTIONS

A NEW SPECIES OF *ACANTHASPIS* AMY. & SERV. (HETEROPTERA: REDUVIIDAE) FROM SOUTH INDIA[1]

DUNSTON P. AMBROSE[2]

(With a text-figure)

INTRODUCTION

Acanthaspis Amy. & Serv. is a well represented genus of the subfamily Reduviinae with thirty nine species from Indian Faunal limits alone (Distant 1902, 1910 and Capriles 1990). The present study adds one more species to this genus based on the examination of micropterous female collected by me from Surulitheertham, South India. This species resembles *Physorhynchus coprologus* described by Annandale (1906) and *Acanthaspis pedestris* Stål (Distant 1902). But *P. coprologus* was considered as an immature form of *Acanthaspis* sp. by Distant (1910) and later as an apterous *Acanthaspis* reduviid by Bergroth (1911). But examination of this species reveals that this reduviid belongs to the genus *Acanthaspis.* Moreover it is neither apterous nor immature but it is a micropterous adult. It can be also differentiated from *A. pedestris* by its prominent black colour and larger size (almost 1.5 times that of *A. pedestris*). Hence it is described as a new species of *Acanthaspis,* namely *A. nigricans.*

Acanthaspis nigricans sp. nov. (Fig. 1)

Type: FEMALE: total length 17.0 mm; width across compound eyes 2.0 mm; width across middle of pronotum 3.5 mm width across middle of abdomen 14.0 mm; black; antennal and tibiae ferruginous; connexival spots yellow; micropterous.

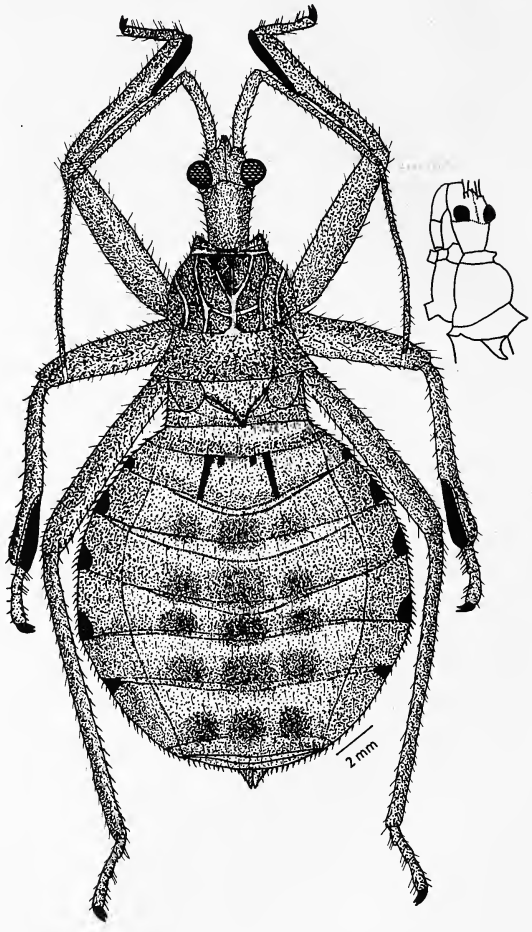

Fig. 1. *Acanthaspis nigricans* sp. nov. Entire dorsal view and head and thorax lateral view.

Head oblong, compound eyes slightly laterally protruded, transverse behind eye; postocular area slightly longer than the centrally and longitudinally impressed an-

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teocular area; antennae slender, scape robust outwardly deflexed and shorter than pedicel; rostrum moderately curved; first and second segments subequal in length and the terminal segment the shortest.

Pronotum unicolourous, transverse behind the middle; anterior lobe little raised, strongly sculptured and medially impressed and posterior lobe strongly rugulose; scutellar spine erect, antero-lateral angles subprominent and posterolateral angles spinously prominent; fore and mid legs subequal in length and hind legs the longest; fore and mid tibiae bear tibial pads; tarsus three segmented and the third segment the longest; legs strongly longly pilose.

Abdomen rounded, segmental sutures prominent; connexivum a little flattened and spotted; abdomen concave above and convex beneath.

Type information: Holotype: FEMALE; Locality: Surulitheertham near Cumbum, South India on 9.5.1988 by the author. Allotype and paratypes not known. The holotype is deposited in the collections of Entomology Research Unit, St. Xavier's College (Autonomous), Palayankottai (N.D. No. 12).

Etymology: This species is named *Acanthaspis nigricans* due to its prominent black colour.

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A NEW SPECIES OF *RHAPHIDOSOMA* (HETEROPTERA-REDUVIIDAE-HARPACTORINAE) FROM WESTERN GHATS[1]

G. RAVICHANDRAN AND D. LIVINGSTONE[2]

(With a text-figure)

Rhaphidosoma madukaraiensis a new species from the Western Ghats has been described and illustrated.

INTRODUCTION

The genus *Rhaphidosoma* Amyot & Serville, is characterized by the elongate head, linear body, aptery, the second rostral segment about five times as long as the first, antennae much shorter than the body and the scutellum obscurely formed. Bergroth (1893) recorded one species, namely *R. atkinsoni*

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from the Oriental region. Subsequently, Distant (1904 & 1910) described another two species, namely *R. tuberculatum* and *R. greeni* from Ethiopian and Oriental regions. The present species is distinctly different from the three already known species and is therefore considered as a new addition to the Oriental species of Harpactorinae.

Rhaphidosoma madukaraiensis sp. nov.
(Fig. 1)

MALE: Length 20 mm, width across the abdomen 2 mm, apterous; elongate; slender; concolourous; griseous; head elongate; anteocular and postocular areas subequal in length; no ocelli; interocular fissure moderately formed; anteocular area behind the antennae dorsally bearing two castaneous elongate markings; antennae far removed from the eyes; antenniferous tubercles rudimentary; postocular area, immediately behind ocelli, tumid throughout, spotted and griseous; antennae concolourous, castaneous; scape a little shorter than the fore femora; pedicel and flagellar segments equal; first joint of the rostrum not reaching even the base of antennae, second joint almost as long as head; eyes piceous; pronotum slightly globose, piceous, spotted almost bare; mesonotum nodule like; metanotum medially carinate, posteriorly obscurely concave; legs castaneous, concolours, abdominal segments obscure; second, third, fourth and fifth segments dorsally with a forked tubercle; behind the fifth segment the abdomen abruptly terminates; (in the males slightly elongated and upwardly covered); connexivum marked as a ridge, ventrally griseous with a median longitudinal line.

This species resembles *Rhapidosoma tuberculatum* by the presence of the abdominal tubercles but it differs from it by the total absence of thoracic tubercles, cephalic spine and by the obscure development of scutellum, wing pads and mesonotal median carina.

Type information: *Holotype:* MALE: Serial No. 125 Madukkarai, 25-4-87, 350

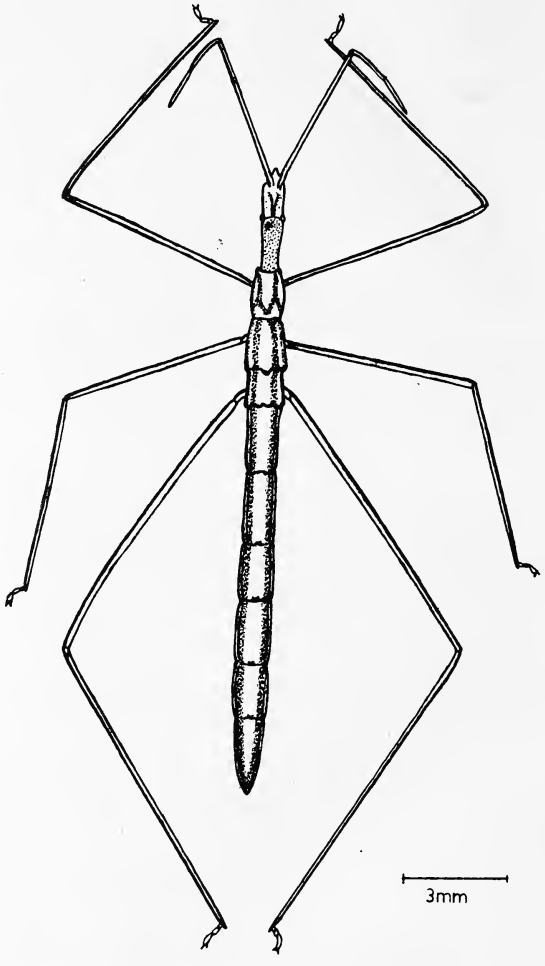

Fig. 1. *Rhaphidosoma madukaraiensis* sp. nov.

MSL, coll. G. Ravichandran. *Paratypes:* MALES bearing same details as that of Holotype, pinned specimens, deposited for the present in the reduviid collection of the Department of Entomology, Fredrick Institute of Plant Protection and

Toxicology, Padappai, S. India to be transferred to National Collection.

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PUNTIUS CRESCENTUS, A NEW CYPRINID FISH FROM SOUTH INDIA WITH OBSERVATIONS ON THE TAXONOMIC STATUS OF SOME RELATED SPECIES[1]

G.M. YAZDANI[2] AND D.F. SINGH[3]

(With a text-figure)

Over the years the Western Regional Station, Zoological Survey of India, Pune has been conducting extensive faunistic surveys of different districts of the Western Ghats, both in Maharashtra and Karnataka. As a result, a very rich collection of fishes is available at this station. In the course of working out the unnamed material of fish from Karwar, we came across some specimens of Cyprinid genus *Puntius* which, on closer observation, proved to be new to science. The new species is described below.

Puntius crescentus sp. nov.
(Fig. 1)

Diagnosis: Carp minnow with a pair of maxillary barbels, without serration on the last undivided dorsal ray; 7 scales in the transverse and 22-23 scales in the longitudinal rows. Lateral line incomplete, ending on or before 4th scale; a lateral black spot at the base of caudal fin; a horizontal dark line along the body and a crescentic black band on the dorsal fin.

Description: B iii; D iii + 8; P 14; V 9; A ii + 6; C 21; L. l. 23; L. tr. 7.

Head length 3.2 (2.8 - 4.16), body depth 2.8 (2.6-3), predorsal length 1.92 (1.6-2.2), pectoral fin length 4.7 (4-7), ventral fin length 4.7 (3.5-6), all in standard length. Body depth 1.1 (1-1.5), snout length 3.3 (2.6-3.5), eye diameter 2.5 (2-3.5), interorbital width 2.1 (2-2.3), all in head length. Eye 0.7 (0.6- 1) in snout length and 1.1 (1-1.5) in interorbital width.

Body laterally compressed. Dorsal profile a little more convex than the ventral

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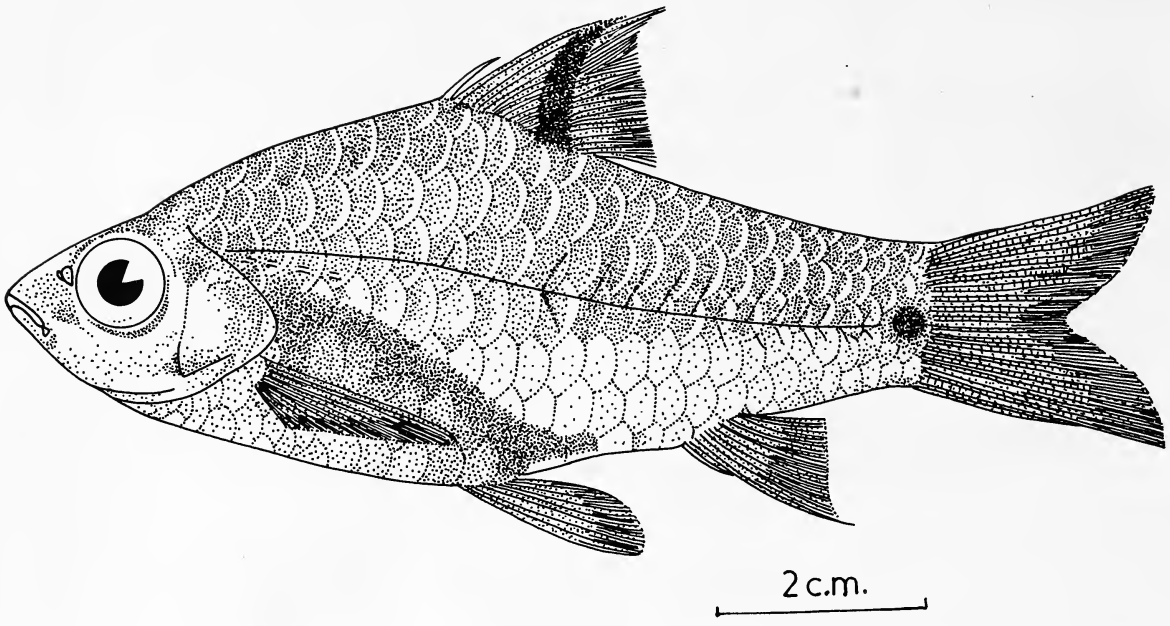

Fig. 1. *Puntius crescentus* sp. nov.

(profile). Head somewhat dorsoventrally compressed, pointed near the snout. Mouth terminal, somewhat upturned. Eyes prominent, situated towards anterior half of head. Dorsal origin slightly in advance of ventral, its first undivided ray almost indistinct, the third longest but weak and without serration on the posterior face. Pectoral origin just behind opercular margin, its rays not reaching the ventral; anal origin behind dorsal. Caudal deeply emarginate, its outer few rays in both the lobes slightly elongated. Outer rays of ventral elongated in some specimens. Scales cycloid, rounded and deciduous. One pair of maxillary barbels present. Lateral line incomplete, ceasing on or before 4th scale; 22-23 scales in longitudinal, and 7 scales in the transverse row. Eight to nine scales before dorsal fin.

Colour (in spirit): Dark brown pigments present all over body and head, but the dorsal half of fish appears darker (than the ventral half) due to presence of heavy pigmentation dorsally. Each scale possesses a series of dark pigments along its outer margin, which, being quite distinct, gives it a characteristic appearance. Pectoral, ventral and anal fins appear colourless but some of their rays are pigmented and in the dorsal fin, present a vertical crescentic dark band between its base and tip. Laterally a round dark spot present at the base of caudal and a horizontal dark line, along the middle of body, from upper edge of operculum to caudal peduncle (ending before the dark spot at caudal base).

The name *P. crescentus* is given to this species since it possesses a very characteristic crescentic dark band on the dorsal fin.

Holotype: 29 mm. Kalinadi at Sunkeri *c.* 7 km east of Karwar, Karnataka (South India). Coll. G.M. Yazdani, December 25, 1975.

TABLE 1
DIFFERENT CHARACTERS IN THE RELATED SPECIES

Characters	*P. crescentus* sp. nov.	*P. vittatus* Day	*P. coorgensis* Jayaram	*P. muzaffarpurensis* Srivastava, Verma & Sharma
Barbels	Present	Absent	Absent	Absent
SL/HL	2.8-4.16	4.0-4.5	2.56-3.52	3.1-3.5
L.l.	Ceasing after 4th scale.	Ceasing after 5th scale.	7 or 8th	5th or 6th
Lateral line scales	22-23	20-22	22-25	22
Predorsal scales	8-9	8	6-7	8
Dorsal fin	Dorsal fin with a vertical crescentic dark band.	Dorsal fin with vertical black streak & a black tip with orange markings.	Dorsal fin colourless.	Dorsal fin with a dark grey vertical band.
Colour	A dark spot at caudal base and a horizontal dark line along middle of body.	A dark spot of caudal base.	Dark tinge at caudal base.	A prominent black spot present above the posterior base of anal fin.

Paratypes: 17 specimens with same details as above.

The type specimens will be deposited, in due course, in the National Collections of the Zoological Survey of India, Calcutta.

Relationship: This new species has been compared with related species like *Puntius muzaffarpurensis* Srivastava, Verma and Sharma, *P. coorgensis* Jayaram and *P. vittatus* Day in the table given above. It will be seen from the Table 1 that characters like the presence of barbels, lateral line scales and a prominent crescentic band on the dorsal fin easily distinguish *P. crescentus* sp. nov. from the other three species. *P. muzaffarpurensis* Srivastava *et al.* is found in the Ganga river system while *P. coorgensis* and *P. vittatus* have been reported from South India (Mysore, Wynaad and Malabar).

Recently, Talwar and Jhingran (1991) have synonymised *P. muzaffarpurensis* and *P. coorgensis* with *P. vittatus*. However, on the basis of prominent differences among the three species (Table 1) we consider them to be valid species.

ACKNOWLEDGEMENT

We thank the Director, ZSI, Calcutta for allowing us to survey the area.

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HORALABIOSA PALANIENSIS, A NEW CYPRINID FISH FROM PALANI HILLS, WESTERN GHATS, SOUTH INDIA[1]

K. REMA DEVI AND A.G.K. MENON[2]

(*With two plates*)

A new species *Horalabiosa palaniensis* is described from Palani Hills. This is the second species to be described under this genus, the first species being *Horalabiosa joshuai* Silas described in 1953.

INTRODUCTION

The genus *Horalabiosa* Silas, 1953, was erected to accommodate a population of small hill-stream fishes which superficially resemble *Garra* Hamilton, but differ from it in the presence of a minutely papillated post-labial callous pad in the mental region. *Horalabiosa joshuai* Silas, the type species, was described from the headwaters of the Tambraparni River at Singampatti, Singampatty Range, Tirunelveli District. Its specific status has been however, disputed by subsequent workers and it has either been overlooked (Jayaram 1981) or synonymised with *Garra* (Talwar and Jhingran 1991). A good collection of *H. joshuai* from Kalakad Wildlife Reserve, Tirunelveli district, however, enabled the senior author to establish its identity and give a detailed redescription of the fish (Rema Devi, in press). The present discovery of another species, from Palani Hills confirms the validity of this genus.

Holotype: In Southern Regional Station, Zoological Survey of India, Madras, Reg. No. F. 3909, Palani Hills, Western Ghats, South India, 77.0 m SL., collected by G.U. Kurup, 27th Feb. 1972.

Diagnosis: a small sized hill stream fish with elongate and slightly compressed body; differs from the other known species in the absence of scales along dorsal base, pre-dorsal region and also along the ventral region.

Horalabiosa palaniensis sp. nov.
(Plate 1, Figs. 1 & 2)

Description: D. 2/7; P. 1/14; V. 1/8; A.2/5; C. 1/17/1; Ll.37; L. tr. 3½ / 2½; predorsal scales absent.

Body elongate, its greatest height below the commencement of dorsal 5.83 in SL; head length 4.24 in SL; height of head 1.81, head width 1.35 in its length; eye diameter 5.78, interorbital width 2.64, snout 2.14 in head length; length of mental pad 4.54, its width 5.56 in head length; length of pectoral fin 1.21, of dorsal 1.51 in HL; base of dorsal 1.43 in its height; length of pectoral fin 5.13, dorsal 6.42, pelvic 6.09, anal 7.95 in SL; predorsal distance 1.98, prepelvic distance 1.82, distance from pectoral to anus 1.99 in SL; the distance from anus to anal fin origin is 4.36 in the distance from pelvic to anal; height of caudal peduncle 1.64 in its length.

Etymology: The species is named after the locality from where collections were made.

Distribution: Palani Hills, Western Ghats, South India.

Relationship: *H. palaniensis* differs from *H. joshuai* (Plate 2, Figs. 1 & 2) in the absence of scales along predorsal and dorsal base and also the ventral side up to anal

[1]Accepted May 1993.

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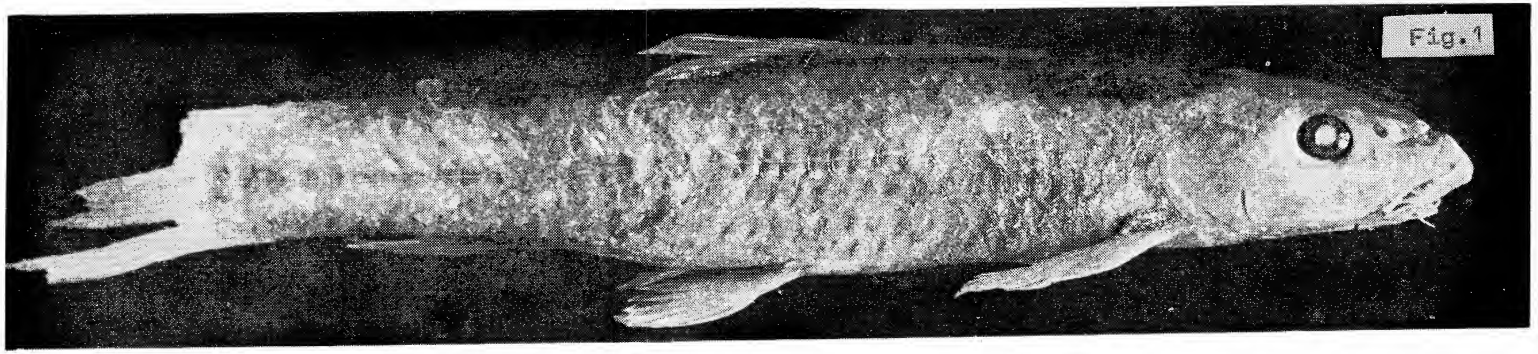


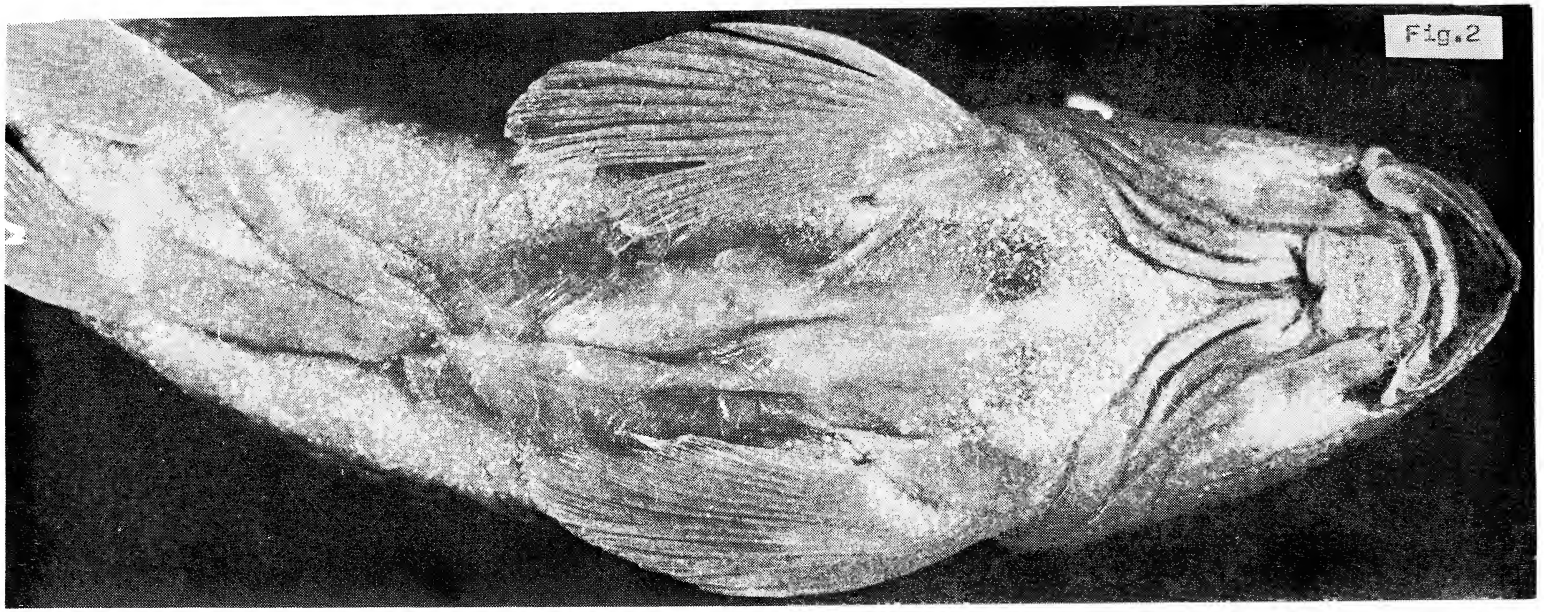
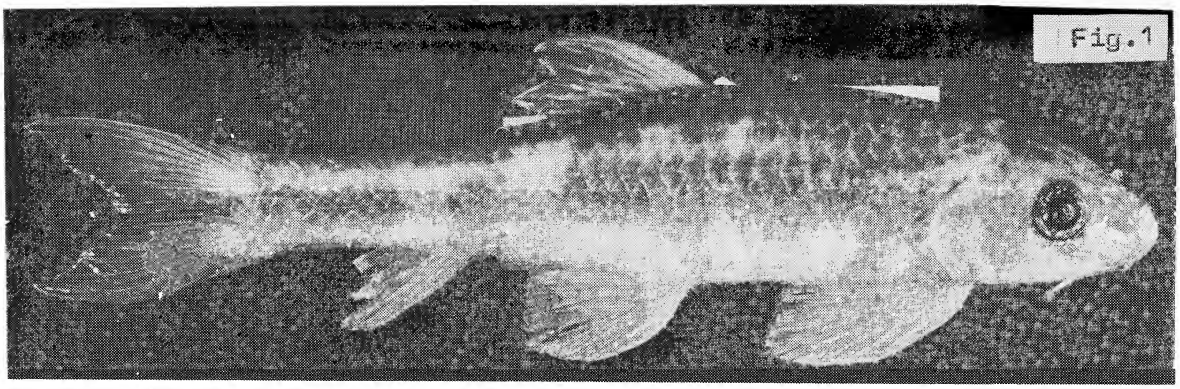


Fig. 1. Lateral view of *Horalabiosa palaniensis* sp. nov., 77.0 mm SL.
Fig. 2. Ventral view of *H. palaniensis*, 77.0 mm SL.



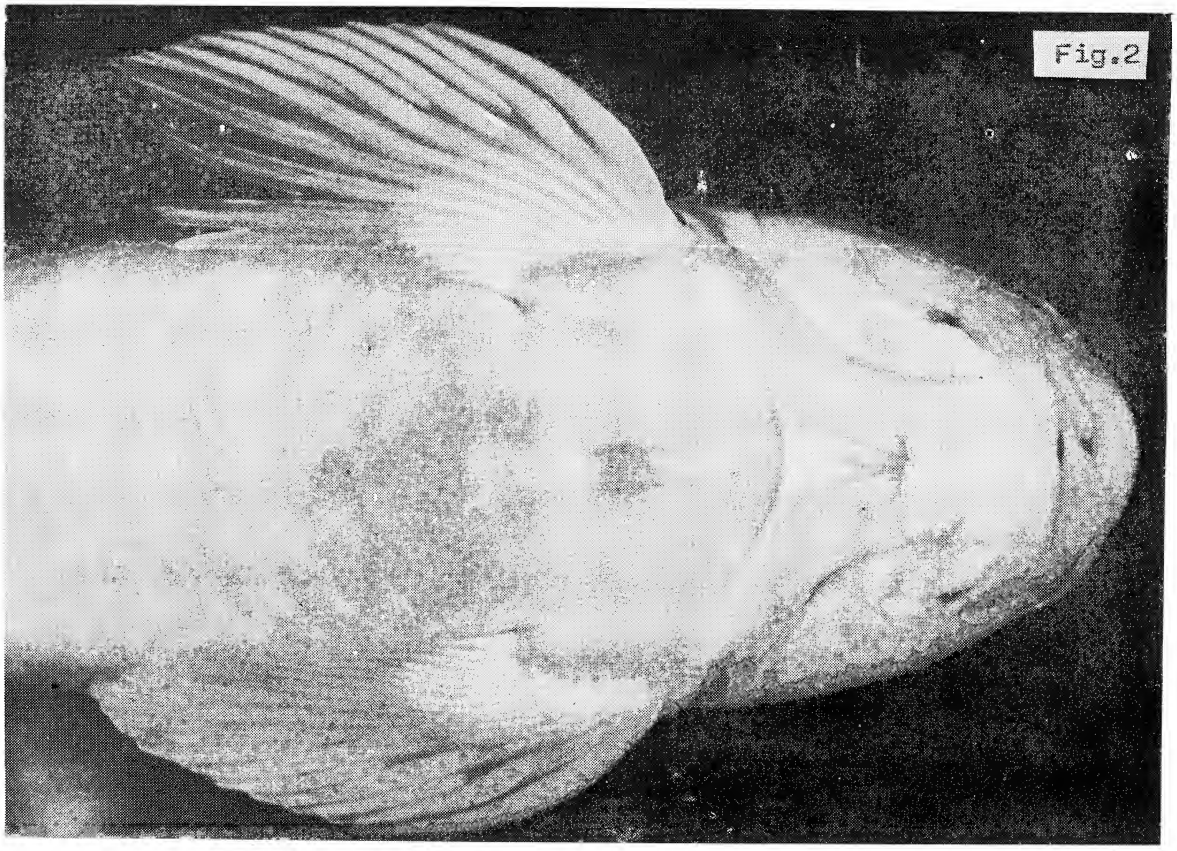


Fig. 1. Lateral view of *Horalabiosa joshuai* Silas, 75.0 mm SL.
Fig. 2. Ventral view of *H. joshuai*, 90.0 mm SL.

origin, whereas in the latter, the chest alone is devoid of scales. Other differences observed in *H. palaniensis* as compared to specimens of *H. joshuai* collected and studied from Kalakad are as follows: The body is more slender in *H. palaniensis* (body depth 5.83 in SL as against 4.45 (3.92-5.56) in SL in *H. joshuai*); head more compressed (head depth 1.81 in its length vs. 1.59 (1.27-1.76); head is longer 4.24 vs. 3.53 (3.09-3.92) in SL; caudal peduncle slender 1.64 vs. 1.24 (0.92 - 1.60) in its length; eye smaller and snout longer in proportion to head length, eye diameter 2.69 vs. 1.65 (1.27 - 2.28) in length of snout; eye 5.78 in head length vs. 4.42 (3.40-5.75) in head length in *H. joshuai*.

Ecology: *H. palaniensis* co-exists with *Garra hughi* Silas, another species, characterised by the absence of scales along the mid-dorsal streak and the ventral region. The loss of scales in these two species is probably due to convergent evolution, the scaleless dorsal surface offering least resistance to torrential mountain currents and the scaleless ventral surface offering broader surface for better adhesion to the rocky bottom.

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, and the Officer-in-Charge of Southern Regional Station, Dr K.V. Lakshminarayana for providing necessary facilities.

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THE GENUS *MACROCHELES* LATREILLE (ACARINA : MACROCHELIDAE) IN INDIA. 4. TWO NEW SPECIES ASSOCIATED WITH DUNG BEETLES (COLEOPTERA: SCARABAEIDAE) FROM SOUTH INDIA[1]

R.K. ROY [2]

(With twenty text-figures)

Two new species of *Macrocheles M. punctovariata* and *M. sisiri* are described from South India.

INTRODUCTION

Phoretic relationship is common among members of the genus *Macrocheles*. Usually females of the coprophilous *Macrocheles* display phoretic association with insects, particularly dung beetles (Evans and Hyatt 1963, Costa 1967). They are predators. The predatory habit of *Macrocheles* is an asset which may contribute to their role as biological control agents in reducing population of dung-breeding flies (Krantz 1983). Phoretic *Macrocheles* are little known in India. Evans and Hyatt (op. cit.) described 4 such new species, namely *ceylonicus*, *krantzi*,

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malabaricus and *nevernalis* from the Indian subcontinent collected off coprid beetles in the collections of the British Museum. They have made a significant contribution to the knowledge of the genus by adding 38 new species on a global basis.

This paper is based on material collected from beetles in the collections of the Entomology Department, University of Agricultural Sciences, Bangalore, Karnataka (South India). The present contribution embodies the descriptions of two new species.

The types would be deposited in the National Zoological Collections, Zoological Survey of India, Calcutta.

Macrocheles punctovariata sp. nov.

FEMALE (Figs. 1-10): Dorsal shield (Fig. 1) 735-825 µm long, 390-480 µm wide, faintly reticulate and bearing 28 pairs of setae. Verticals, j_1, with adjacent insertions, plumose distally; j_4 and z_4 distally pectinate; remaining dorsal setae simple.

Sternal shield (Figs. 2-5) approximately as long as wide, with a well defined series of punctate lines. *L.m.t.* distinct, undulating or procurved; *l. ang.* usually concave medially; *l.o.p.* distinct joining *l.m.t.* in majority of specimens and sometimes arched anteriorly forming a parallel punctate line to that of *l.m.t.* Metasternal shields ovoid, well separated from sternal shield; metasternal setae simple and almost as long as sternals III. Genital shield rounded anteriorly, truncate posteriorly, with a pair of smooth fairly long genital setae inserted posteriorly. Ventrianal shield (Fig. 6) subtriangular, rounded laterally and longer than broad; with a series of seven arched punctate lines traversing the shield between preanal setae I and adanals; preanals, adanals and postanal simple. Metapodals represented by a pair of small weak sclerites posterior to insertions of coxae IV. Stigmata laterad of coxae III-IV, peritremes extending anterodorsally to a point more than half of distance between setal insertions of z_1 and j_1.

Gnathosoma (Fig. 7) with five rows of deutosternal denticles. Tectum as shown in Fig. 8. Movable digit of chelicera (Fig. 9) tridentate, middle one being larger; fixed digit bidentate; dorsal seta simple; cheliceral brush more than half the length of movable digit.

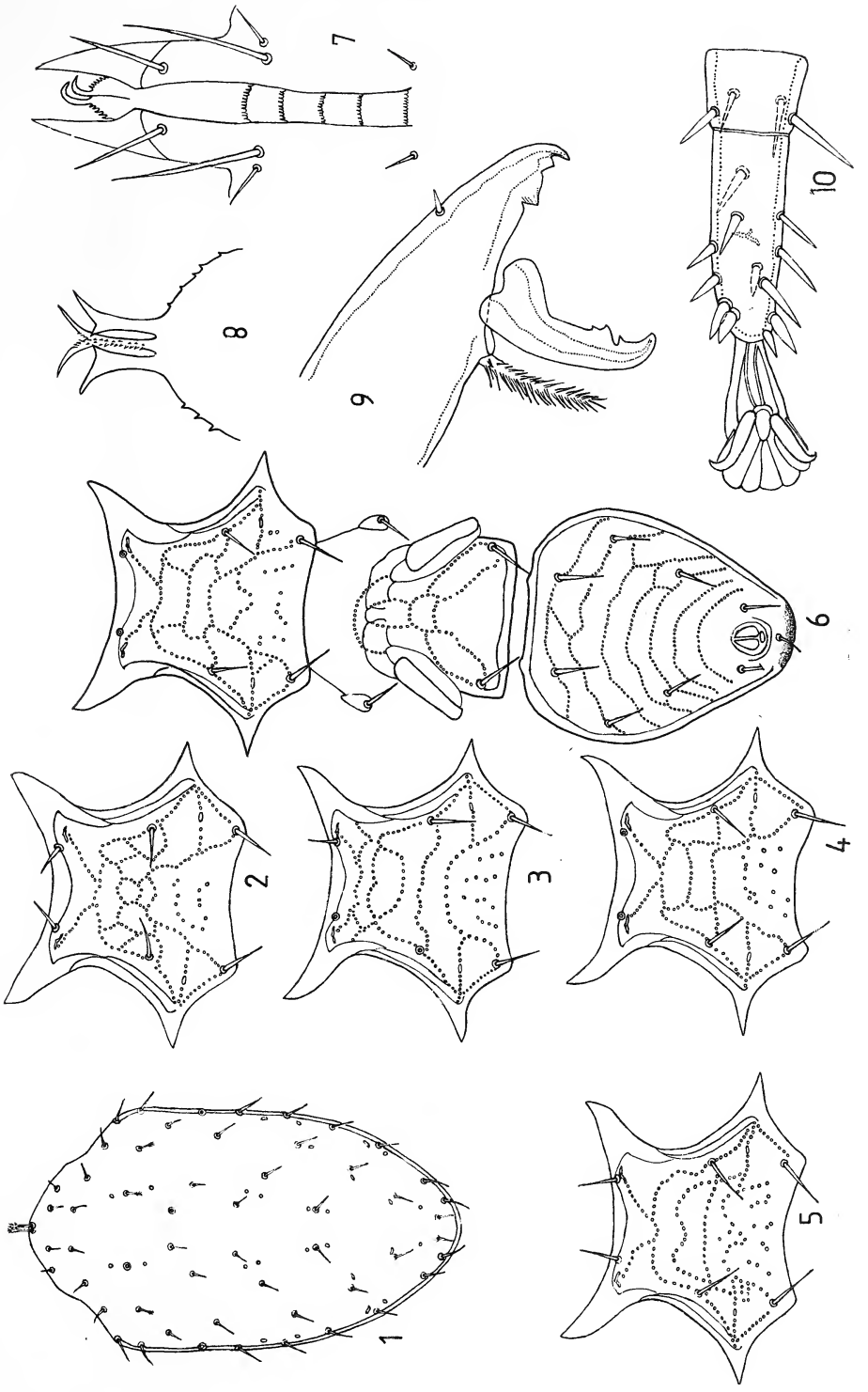
Approximate lengths of legs (excluding pretarsi); I–540 µm; II – 495 µm; III – 480 µm; IV - 690 µm. Tarsus I (105-135 µm) slightly longer than tibia I (90-120 µm); tarsus II (Fig. 10) 105-150 µm; tibia II 60-90 µm. Genu IV with six setae of which av is plumose distally.

MALE: (Figs. 11-15): Dorsal shield (Fig. 11) 555-600 µm long, 360-390 µm wide, weakly reticulate, chaetotaxy as in female excepting setae r_2 being distally plumose.

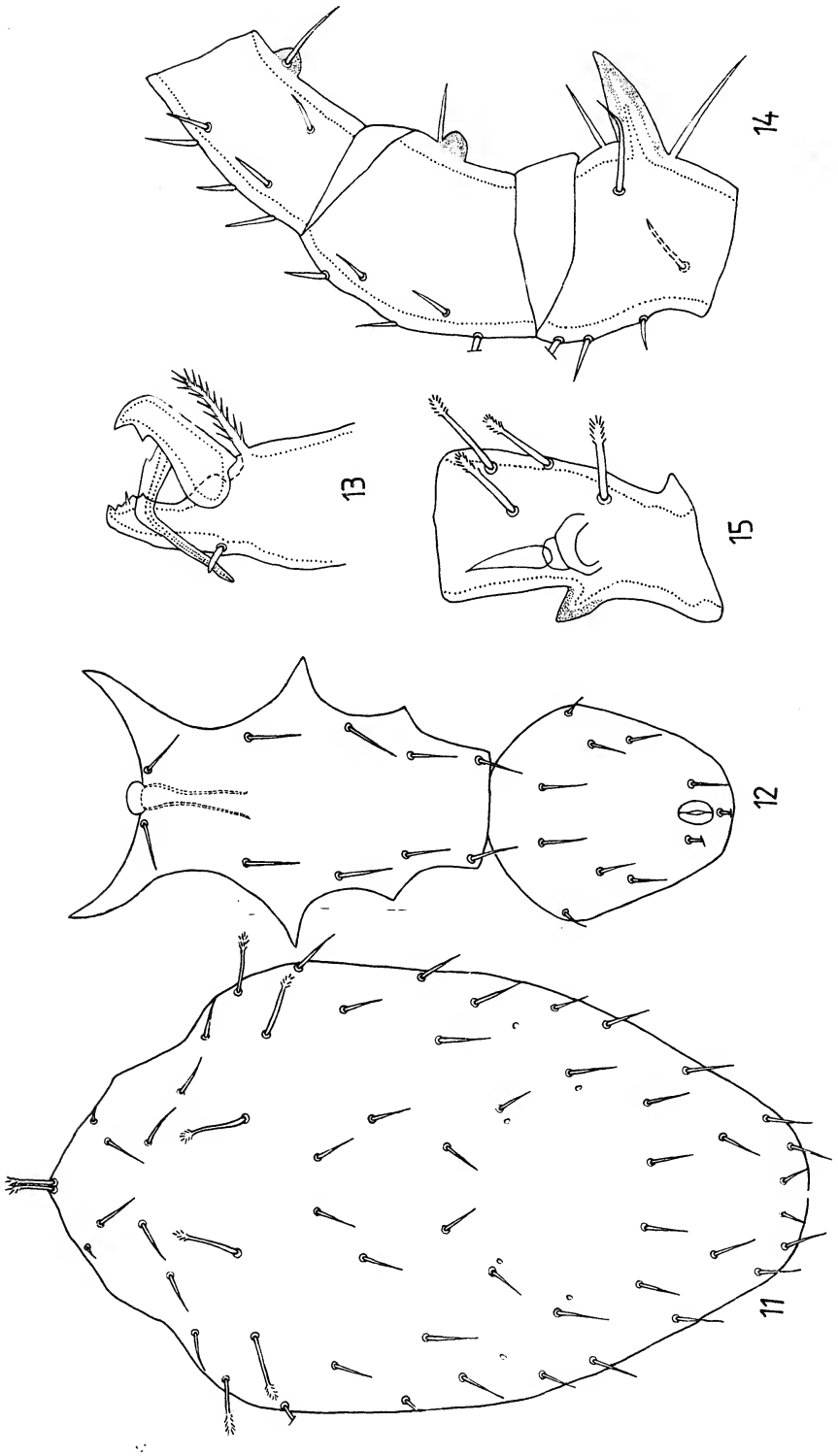
Genital orifice presternal in position. Sternitigenital shield (Fig. 12) 285 µm long, 150 µm wide, without ornamentation and with five pairs of smooth sternitigenital setae (sternal, metasternal and genital setae of female). Ventrianal shield (Fig. 12) 195 µm long, 180 µm wide, unornamented, with 4 pairs of smooth preanal setae including an additional pair of marginal setae; adanal setae simple and long; postanal smooth. Stigmata, peritremes similar to those of female.

Gnathosoma similar to that of female. Fixed digit of chelicera (Fig. 13) tridentate; movable digit unidentate and bearing distally a long spermatophoral process; cheliceral brush extending more than half the length of movable digit.

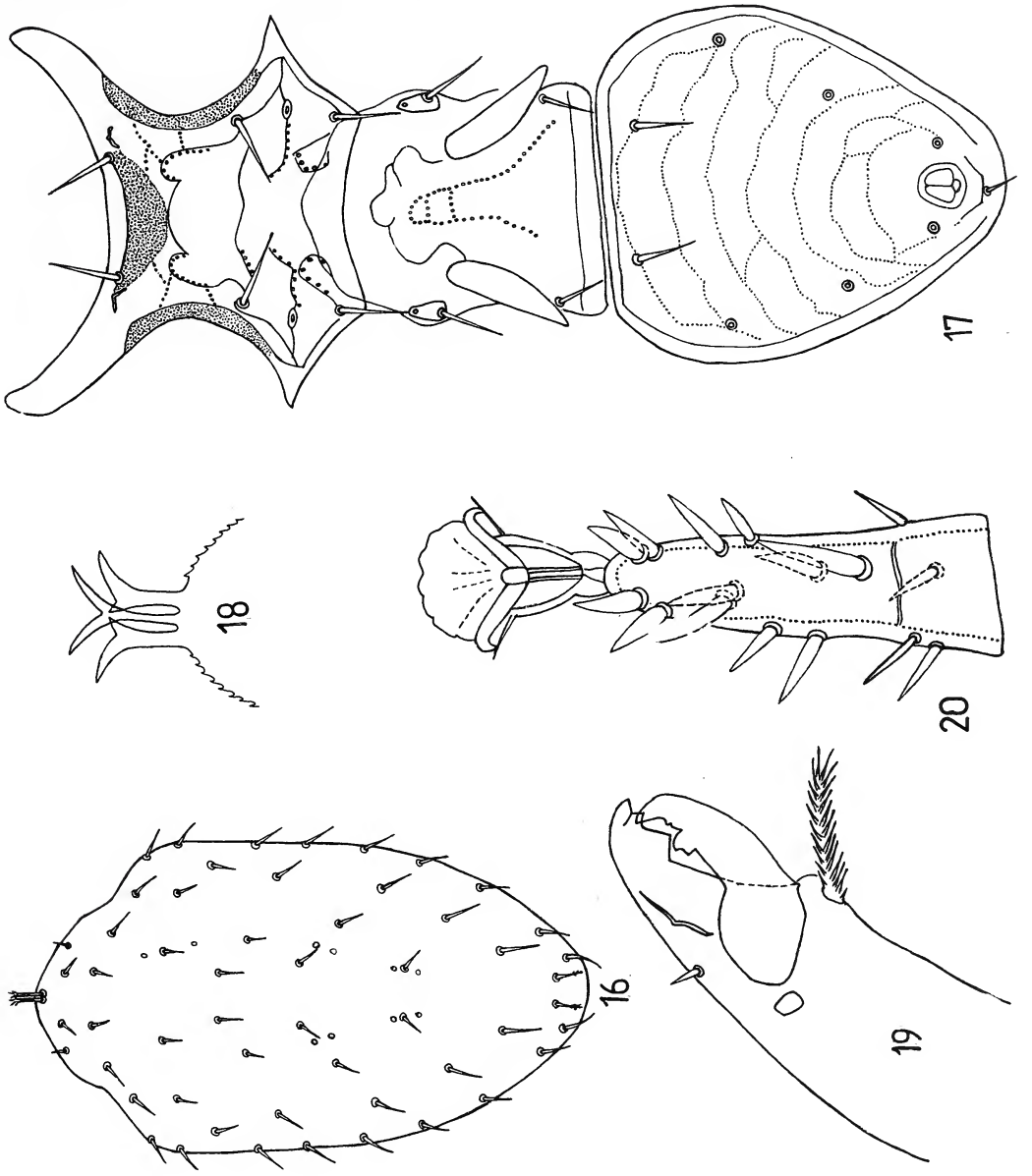
Femur, genu and tibia II spurred (Fig. 14); femur IV (Fig. 15) also spurred. Genu IV with six setae of which al, ad_1 and pd_1 distally plumose.



Figs. 1-10. *Macrocheles punctovariata* sp. nov. Female
1. Dorsum; 2-5. Variation in sternal ornamentation; 6. Venter; 7. Gnathosoma; 8. Tectum; 9. Chelicera; 10. Tarsus of leg II.



Figs. 11-15: *Macrocheles punctovariata* sp. nov. Male
11. Dorsum; 12. Venter; 13. Chelicera; 14. Femur, genu and tibia of leg II; 15. Femur IV.



Figs. 16-20: *Macrocheles sisiri* sp. nov. Female
16. Dorsum; 17. Venter; 18. Tectum; 19. Chelicera; 20. Tarsus of leg II.

Material examined: *Holotype:* FEMALE, Karnataka : Bangalore, ex *Heliocepris* sp., collector and collection date unstated. *Allotype:* MALE, collection data as holotype. *Paratypes:* 7 Females, 1 Male, collection data as above.

Distribution: INDIA: Karnataka.

Remarks: This species superficially resembles *M. carteri* Evans and Hyatt in the nature of ornamentation of the ventral shields. But *M. punctovariata* is interesting in exhibiting considerable intraspecific variation in the sternal shield ornamentation unlike that of *carteri* and also in possessing plumose dorsal setae (j_4 & z_4) which are simple in *carteri*. Since males are non-photrectic, they are very rarely found on beetles. Costa (1967) collected a single male of *M. saceri* Costa from *Scarabaeus sacer* in Israel. Two males of *punctovariata* have been found attached to the coxal region of the beetle (*Heliocopris* sp.).

Macrocheles sisiri sp. nov.

FEMALE (Figs. 16-20): Dorsal shield (Fig. 16) 705-795 µm long, 405-480 µm wide, granular and reticulate and with 28 pairs of setae. Verticals, j_1, pilose distally with their bases being closely apposed; J_5 pectinate or smooth; other dorsal setae simple.

Sternal shield (Fig. 17) granular and with punctate liniae. *L.m.t.* undulating; *l.o.p.* extending almost to the centre of the shield; *l.a.t.* and *l. ang.* porous; *areae punctatae* present; sternal setae fairly long but never reaching insertions behind them and simple. Metasternal shields elongate, each with a simple seta sub-equal to sternals. Genital shield granular, truncated posteriorly, ornamented with punctate lines medially; genital setae in lateral corners and smooth. Ventrianal shield (Fig. 18) 210-270 µm long, 180-210 µm wide, granular, subtriangular, longer than broad, ornamented with punctate transverse lines; ventrianal setae smooth. Metapodal shields circular, adjacent to coxae IV, each with a simple seta. Ventrianal integument with simple setae, nearly equal to preanals. Stigmata normal for genus, peritremes extending anteriorly half way between setal insertions of z_1 & j_1:

Gnathosoma with five rows of deutosternal denticles. Tectum as shown in Fig. 18. Movable digit of chelicera (Fig. 19) with a median bicuspid tooth and I small tooth at apex; fixed digit bidentate, proximal tooth large; cheliceral brush nearly half as long as movable digit.

Approximate lengths of legs (excluding pretarsi): I - 495 µm; II - 465 µm; III 450 µm; IV - 600 µm. Tarsus I (105-135 µm) longer than tibia I (90-105 µm). Tarsus II (Fig. 20) 120-135 µm; tibia II (75-90 µm). Genu IV with six simple setae.

MALE: Unknown.

Material examined: *Holotype* : FEMALE, Karnataka : Bangalore, ex *Copris* sp., collector and collection date unstated. *Paratypes:* 18 Females, same data as holotype.

Distribution: INDIA: Karnataka

Remarks: The general facies of *M. sisiri* are similar to *Macrocheles boxi* Evans & Hyatt. Differences in the nature of ornamentation of the sternal shield, namely absence of *linea angulata*, absence of *areae punctatae*, shape of *linea arcuata*, shape and ornamentation of genital shield in *M. boxi*, are, however, sufficient to warrent separation of the latter from the former.

This species is named in honour of Dr Sisir Kumar Bhattacharyya, Joint Director, Zoological Survey of India, Calcutta.

ACKNOWLEDGEMENTS

I am indebted to Dr S K Bhattacharyya, Joint Director, Zoological Survey of India,

Calcutta for his help and guidance in the course of the study and to Dr G.K. Veeresh, Professor of Entomology, University of Agricultural Sciences, Bangalore, for providing beetle material on which this paper is based.

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*Not seen in original.

NEW AND NOT KNOWN APHIDS (HOMOPTERA : APHIDIDAE) FROM HIMACHAL PRADESH, INDIA[1]

D.K. BHATTACHARYA[2]

(With four text-figures)

Four species of aphids (Homoptera : Aphididae) are recorded from the State of Himachal Pradesh, India. Among these, one, *Eumyzus simlaensis* is new and three species, *Anoecia nemoralis*, *Myzus formosanus* and *Pemphigus mordvilkoi* are new to Himachal Pradesh.

INTRODUCTION

Altogether 251 species of aphids are so far known from Himachal Pradesh, Chowdhury *et al.* (1969), Bindra and Sekhon (1969), Ghosh *et al.* (1969), Chakrabarti *et al.* (1970, 1974), Bhalla (1971), Raychaudhuri *et al.* (1980), Das *et al.* (1981), Chakrabarti and Bhattacharya (1982) and Ghosh (1986).

In this paper four more species are added to the list and the total number of species from the area stands at 255. Among these newly recorded species one, *Eumyzus simlaensis* is new to science. The rest are recorded for the first time from the State.

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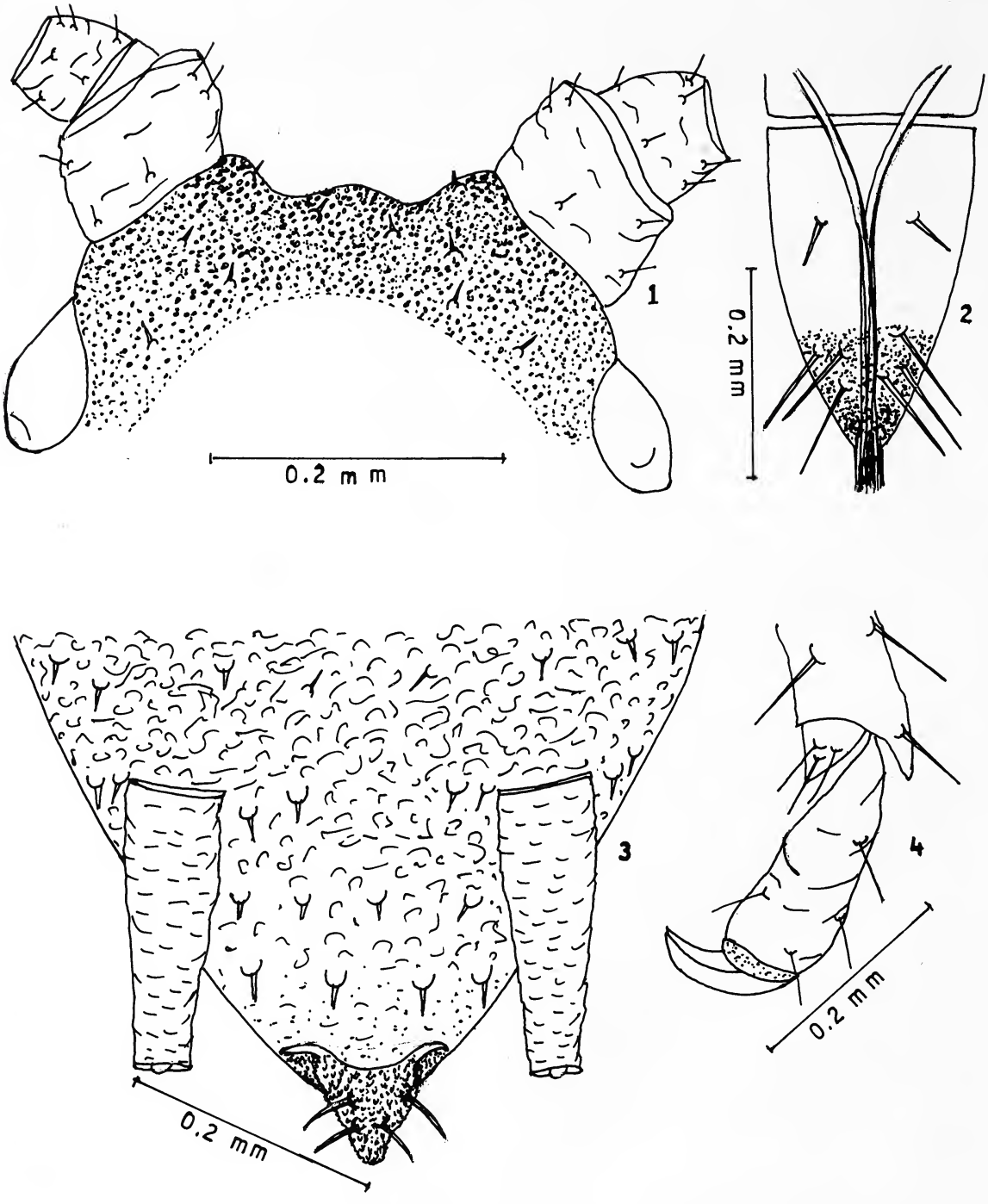
1. **Eumyzus simlaensis** sp. nov.
(Figs. 1-4)

Apterous viviparous female: Body 1.41-1.48 mm long and 0.76-0.78 mm wide. Head brown strongly spinulose both dorsally and ventrally; frons moderately developed with well developed but diverging lateral frontal tubercles; dorsum with 5-6 pairs of short hairs with bluntish apices; longest hair on vertex 0.011-0.018 mm long and 0.5-0.6 times as long as basal diameter of antennal segment III. Antennae 6-segmented with basal two segments little darker than head, but rest of the flagellum pale, 0.60-0.70 times as long as body; segment I and II little scabrous and with 6 and 5 hairs, longest one on segment III 0.50-0.60 times as long as basal diameter of the segment, flagellum gradually and distinctly imbricated apicad; processus terminalis 3.50-3.70 times as long



Figs. 1-4. *Eumyzuz simlaensis* sp. nov.
1. Head; 2. Ultimate rostral segment; 3. Posterior part of abdomen; 4. Second joint of hind tarsus.

as base of the segment VI. Rostrum reaching mid coxae, ultimate rostral segment 1.12-1.30 times second joint of hind tarsus and with 2 hairs. Thorax distinctly scabrous, mid-thoracic furca with a short base. Abdomen brown strongly corrugated, dorsal hairs moderately long with bluntish apices and placed on tuberculate bases; anterior tergites with 8-10 hairs, longest hair on anterior tergites 0.5 times as long as basal diameter of the antennal segment III; tergites 7 and 8 with 5 and 4 hairs, longest hair on each of these tergites 0.50-0.52 times and 0.52-0.53 times as long as basal diameter of the antennal segment III, respectively. Venter with rows of spinules, ventral hairs shorter than dorsal hairs. Siphunculi subcylindrical, brown, poorly imbricated with a distinct flange, 0.20-0.21 times the body length and 0.37-0.40 times the length of cauda. Cauda dark some what buldging anteriorly with a constriction near the apex, bearing 4 hairs. Subgenital plate with 2 hairs on anterior margin and 16-18 hairs on the posterior margin. Legs pale; femora smooth except some corrugations on the apex; tibiae smooth; first tarsal chaetotaxy 3,3,3.

Measurement of the holotype in mm: Length of the body 1.45; width 0.79; antenna 1.01, antennal segments III:IV:V:VI : 0.24:0.13: 0.11: (0.07 + 0.29); u.r.s. 0.08; h.t 2. 0.07; siphunculus 0.06; cauda 0.02.

Holotype: Apterous viviparous female, INDIA: Himachal Pradesh, Simla, 21.ix.1987 from *Prunus* sp. (coll. D.K. Bhattacharya).

Paratypes: 8 apterous viviparous female and many nymphs, collection data as in holotype. The type material of the new species have been deposited at present in the collecction of Entomology laboratory, Department of Zoology, University of Kalyani.

Remarks: The new species by possessing diverging lateral frontal tubercles, dorsal abdominal hairs placed on tuberculate bases with blunt apices and siphunculi without reticulate apex comes under the genus *Eumyzus* Shinji (Chakrabarti and Bhattacharya 1985).

The species in having ultimate rostral segment longer than second joint of hind tarsus bearing 2 hairs, dorsum of abdomen strongly corrugated and dorsal hairs placed on tuberculate bases comes close to *eastopi* (Maity *et al.* 1982) but it differs from the later in having shorter 1.12-1.30 u.r.s. and h.t. 2 ratio (1.68-1.90 in *eastopi*), 4 caudal hairs (6 in *eastopi*) and F.T.C. 3,3,3 (3,3,2 in *eastopi*).

2. **Anoecia nemoralis** Börner

Anoecia nemoralis Börner, 1950, *Neure suropaische Blattlausarten*, 17; Halmgrund (East Germany; England; Netherland); Zwölfer, 1957, *Z. Angew. Ent.*, 40: 214. *Anoecia nemoralis* Börner; Chakrabarti, Maity and Bhattacharya, 1982, *Oriental Insects*, 16 (1): 99-111.

Material examined: 10 apterous viviparous female, 2 alate viviparous female and nymphs, INDIA; Himachal Pradesh; Narkanda 23.ix.1987 from *Triticum* sp. roots (coll. D.K. Bhattacharya).

3. **Myzuz formosanus** Takahashi

Myzus formosanus Takahashi 1923 *Aphididae of Formosa* 1. Part II: 11.

Myzus formosanus Takahashi; Bhattacharya, Mandal and Chakrabarti, 1983. *Entomon*, 8(1): 16.

Material examined: 7 apterous viviparous female and nymphs, INDIA: Himachal Pradesh : Summer hills, 22.ix.1987 from *Impatientinum balsamina* (coll. D.K. Bhattacharya).

4. **Pemphigus mordvilkoi** Cholodkovsky

Pemphigus mordvilkoi Cholodkovsky, 1912. *Rev. Russ. Ent.*, 12 : 493. Ghosh, Chakrabarti and Bhattacharya, 1981. *Bull. Zool. Surv. India*, 4(3) : 320.

Material examined: 15 alate viviparous females and nymphs, INDIA: Himachal Pradesh, Simla, 21.ix.1987 from *Populus ciliata* (coll. D.K. Bhattacharya).

The species were obtained from stem galls of the host plant.

ACKNOWLEDGEMENT

I thank the Head, department of Zoology, University of Kalyani for laboratory facilities.

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ON A NEW SPECIES OF *ZELOMORPHA* ASHMEAD (HYMENOPTERA : BRACONIDAE) FROM INDIA[1]

S.M. KURHADE[2] AND P.K. NIKAM[3]

(With three text-figures)

INTRODUCTION

Zelomorpha Ashmead is a small but widely distributed genus in the Nearctic, Ethiopian, Neotropical and Indo-Australian regions. Shenefelt (1970) recorded twelve species in the world fauna, of which four species are Oriental. According to Bhat and Gupta (1977) eighteen species are reported from the Oriental region, from which ten species are from India. In the present work, a new species, *Zelomorpha guptai* is

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described on the material collected from India : Maharashtra : Ahmednagar, and key to the species groups and species of *Zelomorpha* by Bhat and Gupta (1977) is followed for the determination of new taxa.

Zelomorpha guptai sp. nov. is compared with *Z. punctator* (Roman) and *Z. fulginosa* (Cameron). The species *Z. punctator* is from Philippines and *Z. fulginosa* is from Meghalaya, India.

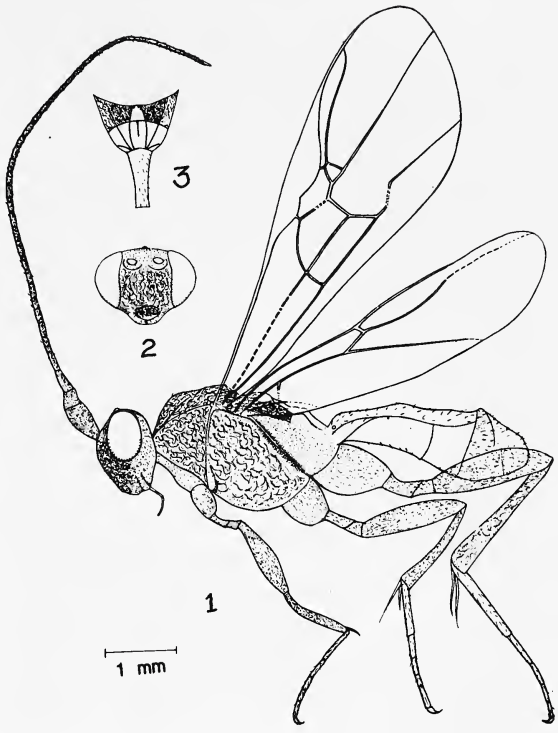
Types and other material of this species are in the collection of the junior author for the time being and will be deposited in the National Collection of the Zoological Survey of India, Calcutta, India.

Zelomorpha guptai sp. nov.

MALE: 6 mm in length (Fig. 1). Head (Fig. 2): 0.5 times as long as wide; vertex shiny, weakly punctate, more or less smooth, pubescent; interorbital distance 2.3 x as the ocello-orbital distance; ocelli in equilateral triangle; oceller region raised; frons depressed, bordered by marginal and frontal carina, very weakly punctate, pubescent; face 0.8 times as long as wide, rugosely, closely punctate, slightly elevated at mid apical region, pubescent; clypeus rugosely, closely punctate, pubescent, 2.3 x as long as the basal width of mandible; mandible bidentate, 3 x as long as its basal width; eye 2.7 x as long as wide, bare; occipital carina absent; temple weakly punctate, wth fine pubescence.

Antenna: 2 + 39 segmented; scape 1.5 x as long as wide; closely punctate, pubescent; pedicel 0.8 times as long as wide, closely pubescent; flagellum pubescent throughout the length; terminal segment 1.6 x as long as wide; penultimate segment as long as wide.

Thorax: pronotum shiny, rugosely, weakly punctate, pubescent; mesoscutum shiny, rugosely, sparsely punctate, pubescent; notauli distinct, compact and complete;



Figs. 1-3. *Zelomorpha guptai sp. nov. male*
1. Adult, lateral view; 2. Head, viewed from front;
3. Propodeum with first abdominal tergite.

scutellum shiny, rugosely, weakly punctate, pubescent; mesopleurum weakly rugoso-punctate, pubescent; mesopleural furrow distinct, extending the length of mesopleurum, moderately, transerversly carinated; metapleurum closely, moderately punctate; propodeum (Fig. 3) carinated, pubescent; areola triangular, 1.2 x as long as wide, smooth; basolateral area rugosely punctate, pubescent; petiolar area with an incomplete median longitudinal carinae. Hind coxa globular, shiny, sparsely punctate, pubescent; 1st trochanter 1.4 x as long as wide; 2nd trochanter as long as wide; femur 3.5 x as long as wide, rugosely, closely punctate, pubescent; tibia 1.2 x as long as femur, slender, rugosely, closely punctate, pubescent; tibial spur 0.45 times as long femur; basitarsus 1.5 x as long as tibial spur; all

tarsomeres spinose; second tarsomere 0.5 times as long as tibial spur; claw bifid.

Forewings: 3.8 x as long as broad; stigma 3.1 x as long as broad; metacarp 1.4 x as long as stigma; 1st abscissa of radius 0.3 times the breadth of stigma, equal to 2nd abscissa of radius; 3rd abscissa of radius 1.3 x as long as stigma; second cubital cell small, with four unequal sides; cubitus 2.5 x as long as stigma, running up to the margin; medius 0.7 times as long as costa; nervulus interstitial, 0.1 times as long as medius; anal cell 20 x as long as wide; margin with fine bristles.

Hind wings: 4.3 x as long as broad; nervellus reclivious, 0.5 times as long as submediella; vannal lobe slightly convex; mediella 2.3 x as long as nervellus; cubitella 1.2 x as long as subcostella; radiella not sclerotised throughout the length; margin with fine bristles.

Abdomen: 4.2 x as long as wide; first tergite longer than wide, 3.3 x as long as basal width, smooth, shiny, sparsely pubescent; second tergite 0.8 times as long as wide, smooth, shiny, weakly punctate, pubescent; suture between first and second, second and third tergite visible; third tergite concealed with remaining tergites, smooth, shiny, weakly punctate, pubescent.

Genitalia: Gonosquammae, gonoforceps and gonostipes with fine bristles; gonosquamma apically blunt and with distinct hair, equal to the length of aedeagus; gonoforceps convex; gonostipes wide basally; distivolsella straight; subgenital plate quadrate, thin, weakly sclerotised; anticosta thick; spiculum absent.

Coloration: Yellowish-red. Antenna, stigma blackish-brown; wings yellowish-brown, with apices light brown; veins yellowish and brownish in basal and apical region respectively.

FEMALE: Unknown.

Holotype: male, INDIA: Maharashtra: Ahmednagar, 15. x. 1988, on wing, coll. S. M. Kurhade, antenna, legs, wings and genitalia mounted on slides and labelled as above.

Paratypes: 6 males, data same as the holotype.

Comments: This species fits in the genus *Zelomorpha* Ashmead, in the key to the genera of subfamily Agathidinae by Bhat and Gupta (1977) for the Oriental region. In the key to the Oriental species of *Zelomorpha* by Bhat and Gupta (1977), *Zelomorpha guptai* sp. nov. is close to *Zelomorpha punctator* Roman (1913). However, it is distinguished from the same in the characters of: (i) vertex weakly punctate, (ii) flagellum blackish brown, (iii) basal 0.4 of fore wing hyaline, (iv) areola 1.2 x as long as wide, (v) scape 1.5 x as long as wide, (vi) second cubital cell four sided.

The new species superficially resembles with *Zelomorpha fulginosa* Cameron (1899) but differs in the following characters : (i) absence of black dense pubescence on face, (ii) metapleurum closely, moderately punctate, (iii) absence of black dense pubescence on propodeum and (iv) nervulus interstitial.

The name *guptai* is in honour of Dr V.K. Gupta, for his contributations to the taxonomy of Indian Braconidae.

ACKNOWLEDGEMENTS

We thank Prof. S.D. Kalyankar, Head, Department of Zoology, Marathwada University, Aurangabad for providing laboratory facilities. The Senior author wishes to thank Principal K. H. Shitole, New Arts, Commerce and Science College, Ahmednagar for permission to do this study at Marathwada University, Aurangbad.

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NEW RECORDS OF TWO PULMONATE FRESHWATER GASTROPODS IN INDIA, WITH DESCRIPTION OF A NEW SPECIES, *BULINUS INDICUS* [1]

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G.P. Gupta[3] and K.M Rao[3]

(With six text-figures)

Introduction

Pulmonate snails of India are classified into four families namely, Lymnaeidae, Ancylidae, Planorbidae and Physidae. The last mentioned family is hitherto represented in India by fossils. Among the other three families, Lymnaeidae and Planorbidae are common and their representatives occur attached to vegetation, submerged objects in lentic waters. The Indian reprsentatives of the family Planorbidae are grouped under three subfamilies, namely Bulininae, Planorbinae and Segmentininae. The first mentioned includes two genera, the most common *Indoplanorbis* and the less common *Camptoceras* (Subba Rao 1989).

A small collection of aquatic molluscs from near Pune has turned out to be interesting and significant, as it adds a species new to India. *Bulinus prinsepii* (*Physa prinsepii*) was recorded from the Intertrappean beds of Deccan (Pascoe 1962). *Physa acuta*, a recent species was recorded from Pakistan. The occurrence of this species is reported for the first time from India.

The subfamily Bulininae is represented by four species in India (Subba Rao 1989). The genus *Bulinus* which is common and represented by several species in Africa is recorded for the first time in India. Several taxonomic investigations were carried out on the genus *Bulinus*. We do not have live material to study the anatomy but the shells are so distinct and different from other known species of the genus that we are inclined to identify the present material as a new species, *Bulinus indicus*. Thus both the species and genera are taxonomically important and are new records for India.

The occurrence of these two species in India has to be viewed with concern since both species have potentialities to act as intermediate hosts of schistosomes.

The species of *Bulinus* are known to be the intermediate hosts of blood flukes, specifically *Schistosoma haematobium*, *S. intercalatum*, *S. bovis* and *S. leiperi* infecting humans, cattle, sheep, goats, and equines (Malek and Cheng 1974). As reports of widespread, although localised, infection of *S. haematobium* among humans causing urinary schistosomiasis in

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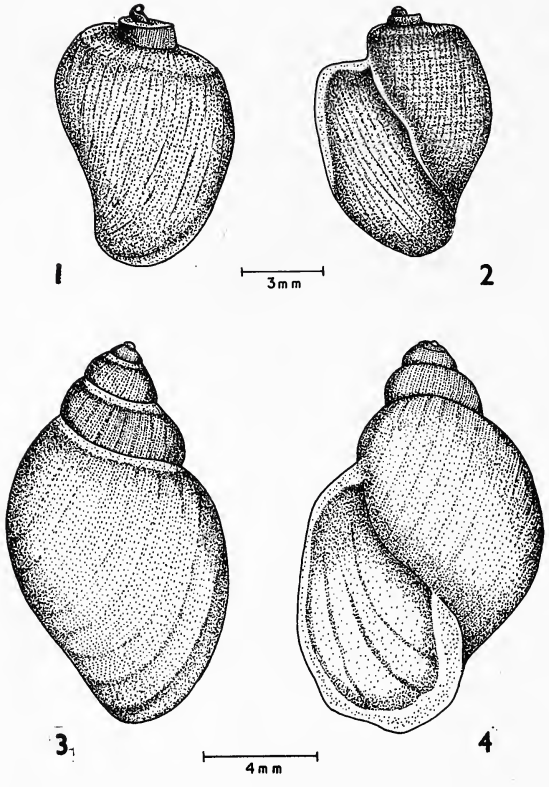

Figs. 1-2. *Bulinus indicus* sp. nov.: Dorsal and Ventral views. Figs. 3-4. *Physa acuta* Draparnaud: Dorsal and Ventral views.

various parts of India have drawn our attention, [Delhi (Dhanda 1959), Madras (Santhanakrishnan and Sundara Rajulu 1967), Raipur, M.P. (Srivastava and Arora 1969), Ratnagiri (Gaitonde *et al.* 1981)], the occurrence of *Bulinus* in India has to be viewed with concern. Further, the occurrence of *Physa acuta* in India is also a matter of concern, as many species of *Physa* transmit avian schistosomiasis (Malek and Cheng 1974).

Family: PLANORBIDAE
Genus: *Balinus* Mueller, 1781

Bulinus indicus sp. nov.

Shell rather small, thin and light, imperforate, transparent to straw-coloured, sinistral, ovate with a large, inflated body whorl; spire disproportionately short (approx. 1/4th total length of shell) being scarcely raised with rather an obtuse apex. Whorls 4, abruptly increasing in size, sharply angulate at the sutures and distinctly shouldered, forming platform above. Sculpture consists of close, prominent transverse lamellae, decussated by irregular microscopic spiral markings; spiral markings more distinct in smaller shells. Aperture large, subquadrately elongate, rounded and expanded at base, scarcely reflected. Columella slightly twisted and has a weakly developed ridge.

AFFINITIES

The shells of *Bulinus indicus* show some affinities to the South African species, *B. abyssinicus* (Martens), *B. depressus* Hass and *B. tropicus* (Krauss) in its general appearance, but differs considerably from all of them. It differs from *B. abyssinicus* in having a broader aperture, the columellar twist being much less distinct and also in lacking the corrugated sculpture on the apical whorls. It differs from *B. depressus* in having a straighter columellar margin, and more distinctly angulate and more pronouncedly shouldered body whorl. It differs from *B. tropicus* in being short-spired and being less concave at the columellar region.

Family : PHYSIDAE
Genus : *Physa* Draparnaud, 1801

Material: 20 specimens, collected from a river at Manjri, Pune, Maharashtra during March and June, 1992.

Holotype: ZSI. Reg. No. M 23293/4
Paratype: 8 specimens, ZSI. Reg. No. M 23294/4
Measurements (in mm):

	Length	Diameter	Length of spire	Max. height of aperture
Holotype:	10.0	6.65	2.9	8.3
Paratypes:	4.35-9.65	2.4-6.2	1.5-2.4	3.6-8.18

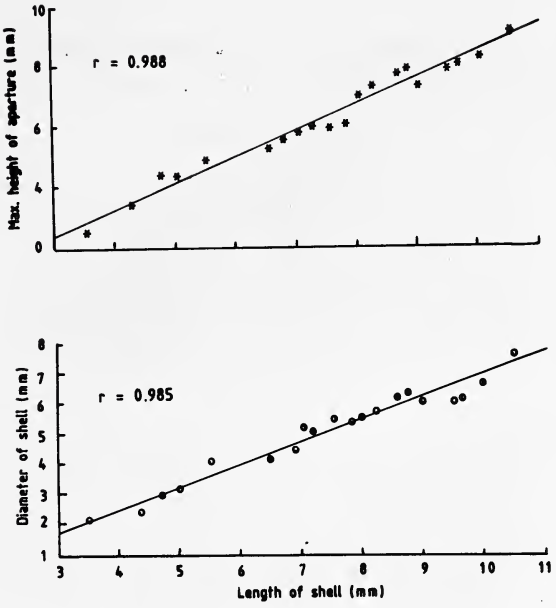

Fig. 5. Ratio of height of shell to diameter of shell and maximum height of aperture in *B. indicus.*

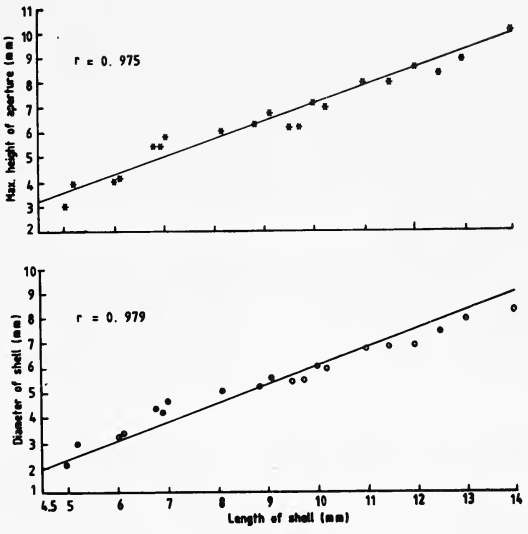

Fig. 6. Ratio of height of shell to diameter of shell and maximum height of aperture in *P. acuta.*

Distribution: The genus *Bulinus* is known from Africa, islands in the Indian Ocean, Iberia, Mediterranean islands and Southwest Asia (Brown 1980).

Habitat: Contrary to the record of many species of *Bulinus,* namely *B. jousseaumei, B. angolensis* and *B. natalensis* which show preference for stagnant water bodies or slow-flowing streams (Brown 1980), *B. indicus* was recorded from a fast flowing river. However, some species are known to occur in seasonal water bodies which remain dry for a considerable period in the year (Brown 1980). Some are recorded from roadside ditches, rice fields and also ponds and lakes. The present species was collected from a river.

Physa acuta Draparnaud

Shell of moderate size, ovate, fairly thick, imperforate, sinistral, glossy and smooth except for fine transverse growth striae, transparent, spire raised and pointed; whorls 6, rounded, body whorl large, globose, sutures oblique; aperture oblong-ovate, outer lip thin, columella twisted, inner lip slightly thickened and expanded.

Tentacles long and slender, whitish in colour, foot and snout slate-coloured. Mantle with finger-like projections. Pseudobranch absent. Radular teeth in transvers oblique rows. Penis simple with a yellowish tip. Eggs are laid in irregularly rounded gelatinous masses inside which individual eggs are arranged in linear rows.

Material: 20 specimens, collected from river banks at Pimpri and a pond at Manjri, Pune, Maharashtra during March and June, 1992.

Measurements (in mm):

Length	Diameter	Maximum height of aperture
5.0-14.0	2.1-7.95	3.0-10.15

Distribution: A North American species introduced into Europe from where it reached Africa (Brown 1980); S.E. Asia (India and Pakistan).

Habitat: This snail has been observed to occur in streams, rivers, temporary ponds, stagnant water of temporary nature

and small, shallow water bodies along river banks, irrigation channels etc. It seems to prefer slightly polluted water and has difficulty in establishing itself away from human habitations (Brown 1980). Perhaps, this snail is well adapted to undergo anhydrobiosis.

It is obvious from figures 5 & 6 above that different shell parameters like length, diameter, eight of aperture in both the species are correlated. Both the diameter and maximum height of aperture are directly proportional to the length of the shell.

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We are indebted to Dr R. V. Swamy, Director, Defence Research & Development Establishment, Gwalior and Dr A. K. Ghosh, Director, Zoological Survey of India for their keen interest in this work. We also thank Mr S. S. Ray, Artist, for the text-figures.

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REVIEWS

1. THE ASIATIC LION — Compiled and Edited by M. A. Rashid and Reuben David. pp. 168 + xxxvii (24 x 18 cm), with 51 plates, 6 text-figures and 7 maps. Baroda, 1992. M.A.B. Project, Department of Environment, Government of India. Price not stated.

The lions of Asoka, dispossessed of their rightful position as the National animal and dispossessed of their habitat, live desperately in the small and only patch of forest, the Gir, in Saurashtra, Gujarat. In this book, M.A. Rashid takes a comprehensive look at one of India's most precious and most neglected national heritage, the single existing population of the Asian Lion. I say neglected for, if a fraction of the money that has been spent on the rehabilitation of the tiger had been spent on the Lion, its position would not have been as precarious as it is today. The book starts with a brief introduction of the author and of the state of wildlife in India. Animals slip into mythology when they impress man and the Lion has been a "symbol of strength and power" throughout its erstwhile range from Egypt to Bihar. From the Sphinx on the Nile to the Narsimha of Hampi, the Lion in mythology has been described in detail in the second chapter.

The past distribution of the Lion and its gradual and, after the advent of the sporting gun, rapid disappearance from all its past range; the Gir habitat and the animals that live therein; the habits and behaviour of the Lion are covered in the following chapters till one gets to the crucial chapter on Lion census. Numbers in a species which has been reduced to the straights that the Lion has been, are indeed vital. The methods that have been employed are basically direct and indirect counts and kept as simple as possible, to be usable by enumerators of varying capability. It does not seem that any statistical method was used to test the validity of the results. However, by the last count in 1990, it is estimated that 284 Lions now exist in the Gir Forest. Even this number, small as it is, has raised conservation problems which stretch beyond the limits of the Gir. The discussion on protection shows clearly how conservation of the Lion has suffered from benign neglect over the years. The only bright spot in the history of Lion conservation is the implementation of the Gir Lion Sanctuary Project in 1972, which fenced the area of the Sanctuary, presently the national park, with a rubble wall, removed the Maldhari settlements within and stopped all grazing. The recovery of the area has been remarkable, but at the cost of shattering the Maldhari community. A forest people, they were removed to a barren wilderness and destroyed by broken promises. The damage that is done by uprooting people and breaking down established social structures is little understood by Government Departments. As far as the Lions of the Gir are concerned,their habitat still remains threatened. The decision taken in 1982 to notify the whole area as a National Park is still to be implemented. The search for alternate homes and the rehabilitation of the Barda hills as a second home remain unfulfilled.

The last chapter gives a list of recommendations, a strategy for the conservation of the Lion. One of the identified problems is tourism that has grown enormously and the difficulties of seeing or showing Lions. The Lion shows which used to attract large

crowds of unmanageable people have since been rightly discarded. Incidentally, one lion show arranged for a former President by the author was somewhat of an anticlimax as the party when they reached the site saw the bait, a buffalo, being casually eaten, while still alive, by a group of young 'learner' Lions. The President fled the scene heaping abuse on the author. If you want to show Lions to a VIP you must be careful to invite the right Lion! The Lion has had considerable attention from the scientific community commencing with the researches sponsored by the Bombay Natural History Society and the Smithsonian Institution in the early seventies. There has been a continuing scientific presence at the Gir. Presently the Wildlife Institute of India is active in the Gir. The strategy recommendations are based on these scientific inputs and the author's long experience.

I am rather disappointed. I know M. A. Rashid as a good raconteur, with a delightful sense of humour, but the book does not come alive. It reads like a well researched report. The second author and his contribution seem to be appendices, a tribute to a friend and a lovable person.

I cannot resist quoting the author's remarks on his efforts to get conservation action from Government and in the process identifying the virus or evil genie (depending on whether your perception is modern or mythological) that affects Government departments. "It is indeed tragic that the final say in such matters should rest with the Department's Financial Advisor who knows and understands nothing about wildlife and its conservation and could not care less about the dire consequences of his intransigence in considering the Department's proposals. Unless some effective method can be found to release this deadly stranglehold, all the efforts and labour of the Department's Wildlife Wing will end up as an exercise in futility". How dreadfully true!

J. C. DANIEL

2. JUNGLE AND BACKYARD — By M. Krishnan. PP. 138 (21.5 x 13.5 cm) with illustrations. Madras, 1993. Oxford University Press. Price Rs. 100/-

A generation of naturalists had cut their teeth on the writings of M. Krishnan, the doyen among Indian natural history writers. This small and varied collection of elegant essays on facets of the life and habits of Indian wildlife should raise nostalgic memories. Krishnan, whether describing a tusker taking a mudbath, or the insidious inroads that has been made into the Indian wilderness by the lantana, writes natural history based on personal observations. Krishnan's integrity is reflected in these essays. He wrote of what he saw, without frills, and with a wry sense of humour. How does one tame a hunting cheetah? A pastime now mercifully a matter of history as the cheetah is extinct in India and its prey, the blackbuck, severely endangered. Krishnan reports that you catch it as an adult and break its spirit; its wildness.

Perhaps all domestication, whether of an elephant or of a falcon, follows the same principle. The dog apparently gave up thousands of generations ago. Krishnan's acute powers of observation are well served by his writing, whether describing the manner in which a cat goes over a wall or a stand-off between a mongoose and a ban-

dicoot. Unfortunately, for those it would most benefit, the student community, the book is steeply priced — or perhaps the reviewer suffers from the illusion that even in these days of inflation one hundred rupees is a high price!

J. C. DANIEL

3. THE DISCOVERY OF EVOLUTION. By David Young. pp. 256 (25 x 19.5 cm) with 16 colour plates and many illustrations. London, 1992. Natural History Museum Publications in Association with Cambridge University Press. Price not stated.

"What I offer you here is a journey for the mind and adventure in the realm of ideas ..... we shall go back in time and retrace the steps of the men who developed the theory of biological evolution". Thus, David Young summarises the contents of this very interesting book.

Using a narrative style, this book shows how science being a human activity, scientific discoveries are subject to circumstance, personal prejudices, fallibility, serendipity and brilliance. Each discovery accretes onto an existing theoretical framework and a problem may take decades if not centuries to be solved. This is why biologists of today do not ponder over terms such as genotype or phenotype any more than whether acquired characters are inherited. Natural selection, DNA structure, and mutagenesis are all part of our intellectual heritage. Since the discovery of the structure of DNA in 1953, genetics, molecular and evolutionary biology have made considerable advances. Today, at the end of the 20th century, the understanding of the information storage and retrieval systems of the brain, and controlling the expression of oncogenes, are among the new biological frontiers.

The unveiling of the concept of evolution took many centuries and involved many personalities stretching as far back as Aristotle who, in the 4th century B.C. in his capacity as tutor to Alexander the Great, was able to collect biological specimens from the realms conquered by his student. David Young builds on Aristotle's classification of organisms and begins his narrative in the seventeenth century, with the contributions of Ray, Descartes and Hooker. The problems confronting the early naturalists and philosophers were no less compelling, confusing or difficult than those faced by present-day natural scientists. Any concept or theory can only advance or be understood within the prevailing social, theological and intellectual milieu. Therefore, at that time in the western world, answers to the compelling questions and even the framing of the questions themselves, were constrained by the Christian doctrine of special creation and a literal acceptance of the words of the Bible. For example, how can a species change its form and functions if all species were created at one time by a Supreme Being? If all the species that survived after the flood were located in one area (perhaps Mount Ararat where Noah's ark was supposed to have come to rest), how did species come to inhabit areas of the earth that are unconnected by land today? In a world ordered by divine providence, how can fossils represent extinct animals, for surely a Creator would not allow his creations to vanish from the earth? How can fossils of marine animals be found at the tops of maountains? How can the world be older than that ordained in the Book of

Genesis? David Young shows how the resolution of each problem only gave rise to more questions and newer dimensions to the history of life.

The developing fields of comparative anatomy, embyology, geology, palaentology and microscopy contributed to the understanding of species origins, extinctions and current distributions with the worked of such personalities as Linnaeus, Comte de Buffon, Werner, Hutton, Cuvier and Lamarck in the eighteenth century.

As the historical journey enters the nineteenth century, the reader reaches Darwin, who brooded quietly over his theory of evolution by natural selection for nearly twenty years before being forced by Wallace to jointly shatter the old theory of special creation. Happily enough in this book, Darwin isn't stressed any more or less than his contemporaries Lyell, Wallace and Huxley. The development of the theory of evolution by natural selection has much to owe to all these other personalities. Following the trail of the units of inheritance, the story moves into the twentieth century in the wake of Mendel and deVries culminating in the contributions of Dobzhansky, Fischer, Mayr and Simpson.

This book is largely written for the layperson in a lucid, logical style. The reader's interest is sustained by easy, flowing prose and the problem-solving approach. Concepts are explained in lay terms without distortion of the facts.

There are excellent colour plates and black and white illustrations, many of which are reproductions of original illustrations made by the scientific personalities themselves. A useful addition to the text is a section entitled "Evolutionary who's who" which provides an alphabetical list of the personalities in the book, each entry accompanied by a short biographical sketch. This is followed by a guide to further reading in the various areas of evolution introduced in the text.

This is a good book on the growth of thought concerning the evolution of species. I recommend this book highly to the layperson and professional alike.

RENEE M. BORGES

4. A BOOK OF KERALA BIRDS — By K.K. Neelakantan, C. Sashikumar, R. Venugopalan. pp. xxxii +146 (21.5 x 14 cm) with 4 colour plates and text-figures by Carl D'Silva. Trivandrum, 1993. WWF-India. Price not stated.

The Kerala avifauna has had dedicated followers from the time of Ferguson, the Curator of the Trivandrum Museum at the turn of the century through Salim Ali to K.K. Neelakantan. There are perhaps more competent birdwatchers in Kerala than any other State in India. The vigour of ornithology in Kerala is largely the result of two publications, the Birds of Kerala by Salim Ali and K. K. Neelakantan's Malayalam monograph on the Birds of Kerala.

K.K. Neelakantan was the leading light in Kerala ornithology and contributed substantially to the development of ornithology as a hobby and as a serious scientific pursuit. In this book, the authors describe the 95 species that have been identified, some positively and some tentatively, as additions to the bird list of Kerala since the publication of the BIRDS OF KERALA by Salim Ali in 1969. Some of the sightings such as of the Spoonbilled Sandpiper and the Peninsular or Ripley's Bay Owl are very exciting indeed.

Some of the species listed as requiring verification would be equally stimulating to the birdwatcher if confirmed. The descriptions are competently done and the book forms a useful addendum to Salim Ali's BIRDS OF KERALA. The plates, though the depictions are good, are somewhat dull; possibly because of the background. One looks forward to seeing part 2 which will have additional data on the species described in Salim Ali's BIRDS OF KERALA. World Wide Fund and Thanal are to be congratulated on this useful publication.

J. C. DANIEL

5. CURRENT INDIAN FORESTRY, ENVIRONMENT & WILDLIFE. Abstracts Vol. 1. Edited by Sudhir K. Arora. Dehra Dun, July, 1993. Agrim Publishers. Annual Subscription Rs. 275/-, Foreign U.S. $ 50 Air Mail, $ 35 Surface Mail.

The CIEEWA, as it is abbreviated is probably the first attempt at publishing abstracts of articles from exclusively Indian Journals. The first issue covers 17 Journals covering Forestry, Environment and Wildlife. The forestry section covers 32 interlinked disciplines, the Environmental Sciences 8, and Wildlife 9 disciplines. The abstracts could have been more concise. We hope that the whole spectrum of Journals concerned with environmental sciences will be covered in due course. A commendable effort at information dissemination.

J.C. DANIEL

MISCELLANEOUS NOTES

1. PARTURITION IN FERAL RHESUS MACAQUE (*MACACA MULATTA*): A CASE REPORT

Jaipur City has *Macaca mulatta* and common *Presbytis entellus* since time immemorial (Mathur and Manohar 1989). Their density is high in the old city of Jaipur (Mathur and Manohar 1990a). The groups at Ambagarh Reserve Forest (ARF) have been under observation since October 1985. ARF has 7 langur and 5 rhesus groups (Mathur and Manohar 1990b). In 7 years of study only on one occasion, a rhesus female was seen giving birth. On 29.5.87 at 10.30 a.m. at ARF I was taking notes on Tamarindus group of rhesus, which had 64 animals (8 adult males, 26 adult females, 4 subadult males and 3 subadult females, 7 juveniles and 16 infants). An adult female drew my attention, as she was making circling movements and sitting intermittently. She appeared restless. She inspected her genitalia frequently with her hands, sniffed the hands and genitalia alternately. In between she also looked at her hind quarters. The entire sequence of parturition was witnessed and recorded minute by minute.

10.30 The female was noticed making peculiar movements. None of the other group members noticed her though they were foraging closeby.

10.32 She appeared restless, no specific vocalization or gesture.

10.33 She squatted many times while still continuing with circling movements.

10.35 While she squatted, contractions in her abdominal region were very conspicuous. She kept her palms on her knees.

10.39 She touched her genitalia and looked at them; mucus was discharged, licked her fingers, a swelling appeared in vaginal area.

10.40 Female explored its genitalia, blood came out. She sat, stood again, blood kept coming out. Something was seen protruding, probably the head of infant.

10.41 Circled, bent and licked the blood, sat on her rump, separated hind legs, bent down and looked at the protruding infant's head. There were no apparent signs of pain. The female was neither vocalizing nor had any special facial expressions. The infant was coming out smoothly, female did not use her fore/hind limb to pull the infant out.

10.42 The infant was out. The placenta came out simultaneously. Female held the infant and inspected; she sniffed and licked blood.

10.43 Mother chewed the umbilical cord to separate it from the placenta, licked the blood from infant's fur but did not pick up the infant.

10.44 Female started eating amniotic sac and placenta.

10.45 Another adult female with infant approached and sat about a meter away.

10.46 Baby was on ground close to the mother, it was making faint noises while also moving its limbs; mother was busy eating placenta, almost ignoring the infant.

10.49 Placenta was consumed completely; the other female who was watching, left.

10.50 Umbilical cord consumed completely.

10:51 A juvenile approached and looked at the female. Mother continued cleaning infant by licking. Mother picked up the infant and licked the blood off its body.

11:01 Vocalization by infant increased both in frequency and in pitch.

11:03 Female with the new born moved towards a group of females and sat among them.

11.05 The other females looked at the new born, the juveniles came close and sniffed.

11:06 Mother kept sitting at one place with the group and licked the infant intermittently.

The actual delivery of the baby was very short and quick. The entire act took 30 minutes. The infant's head was first seen coming out at 10:40 and in two minutes the entire body was out. The ease with which the female delivered the baby, indicated its multiparity.

September 9, 1993 REENA MATHUR

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2. INFANT SURVIVAL AND MORTALITY IN FREE-RANGING HANUMAN LANGURS, *PRESBYTIS ENTELLUS* JODHPUR, WESTERN INDIA

Studies of non-human primate life histories are vital because life histories are key elements of population dynamics. Detailed studies of life tables and demographic parameters for free- ranging non-human primates are still comparatively rare (Winkler *et al.* 1984). In this paper, I present life tables for infants born in three troops of Hanuman langurs (*Presbytis entellus*) between December 1982 and September 1985. These troops named B, KI and KII lived in a semi-arid habitat about 8 km west of Jodhpur in Rajasthan State, Western India. Long-term troop history details are also available for these troops (Agoramoorthy *et al.* 1988). The study troops were monitored between December 1982 and September 1985 to record demographic and social behaviour data (Agoramoorthy and Mohnot 1988). Ad- libitum sampling was used as observational method (Altmann 1974). In total 41 new born infants were observed during my study with a total sex ratio of 0.46 female per male. One still birth in troop B has been excluded from the sample. Life tables for the period from birth to twelve months of life were worked out. Calculations were based on Caughley (1977) by using the mortality rate (qx), that is proportion of animals alive at age x that die before the age $x + l$. The px, lx, dx were converted from qx. This method was preferred instead of calculating lx directly from the animals still alive at a given age out of total f. The sample fx gives the total number of male and female infants still surviving at the

TABLE 1
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP B OF HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample fx		Mortality rate qx		Survival rate px		Survival lx		Mortality dx	
	M	F	M	F	M	F	M	F	M	F
0	10	2	0.100	0	0.900	1.000	1.000	1.000	0.100	0
1	9	2	0.111	0	0.889	1.000	0.900	1.000	0.100	0
2	8	2	0	0.500	1.000	0.500	0.800	1.000	0	0.500
3	8	1	0.125	0	0.875	1.000	0.800	0.500	0.100	0
4	7	1	0	0	1.000	1.000	0.700	0.500	0	0
5	7	1	0	0	1.000	1.000	1.000	0.700	0	00
6	7	1	0	0	1.000	1.000	0.700	0.500	0	0
7	7	1	0	0	1.000	1.000	0.700	0.500	0	0
8	7	1	0	0	1.000	1.000	0.700	0.500	0	0
9	7	1	0	0	1.000	1.000	0.700	0.500	0	0
10	7	1	0	0	1.000	1.000	0.700	0.500	0	0
11	7	1	0	0	1.000	1.000	0.700	0.500	0	0
12	7	1	0	0	1.000	1.000	0.700	0.500	0	0

M = Male; F = Female.

TABLE 2
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP KI OF HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample *fx*		Mortality rate *qx*		Survival rate *px*		Survival *lx*		Mortality *dx*	
	M	F	M	F	M	F	M	F	M	F
0	5	7	0.200	0.142	0.800	0.858	1.000	1.000	0.200	0.
1	4	6	0	0	1.000	1.000	0.800	0.858	0	0
2	4	6	0	0	1.000	1.000	0.800	0.858	0	0
3	4	6	0	0.166	1.000	0.834	0.800	0.858	0	0
4	4	5	0	0	1.000	1.000	0.800	0.716	0	0
5	4	5	0	0	1.000	1.000	0.800	0.716	0	0
6	4	5	0	0	1.000	1.000	0.800	0.716	0	0
7	4	5	0.250	0	0.750	1.000	0.800	0.716	0.200	0
8	3	5	0	0.200	1.000	0.800	0.600	0.716	0	0
9	3	4	0	0	1.000	1.000	0.600	0.573	0	0
10	3	4	0	0	1.000	1.000	0.600	0.573	0	0
11	3	4	0	0	1.000	1.000	0.600	0.573	0	0
12	3	4	0	0	1.000	1.000	0.600	0.573	0	0

M = Male; F = Female

TABLE 3
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP KII OF HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample *fx*		Mortality rate *qx*		Survival rate *px*		Survival rate *px*		Mortalit *dx*	
	M	F	M	F	M	F	M	F	M	F
0	13	4	0.154	0	0.846	1.000	1.000	1.000	0.154	0
1	11	4	0	0.250	1.000	0.750	0.846	1.000	0	0.250
2	11	3	0.091	0	0.910	1.000	0.846	0.750	0.077	0
3	10	3	0	0	1.000	1.000	0.769	0.750	0	0
4	10	3	0	0	1.000	1.000	0.769	0.750	0	0
5	10	3	0	0	1.000	1.000	0.769	0.750	0	0
6	10	3	0	0	1.000	1.000	0.769	0.750	0	0
7	10	3	0.200	0.333	0.800	0.667	0.769	0.500	0.154	0.250
8	8	2	0	0	1.000	1.000	0.615	0.500	0	0
9	8	2	0	0	1.000	1.000	0.615	0.500	0	0.250
10	8	2	0	0.500	1.000	0.500	0.615	0.250	0	0
11	8	1	0	0	1.000	1.000	0.615	0.250	0	0
12	8	1	0	0	1.000	1.000	0.615	0.250	0	0

M = Male; F = Female.

respective months after birth.

Troop B: A total of 12 births (two females and 10 males) were recorded in troop B. Only eight of them reached the age of 12 months (Table 1). One infant disappeared at 0.5 month of age and three were killed by a new resident male when the ages of infants were between 1-2, 2-3 and 3-4 months.

Troop KI: A total of 12 births (seven females and five males) were recorded in troop KI. Five of the infants died; a male and female between 0-1 month, a female between 3-4 months, a male between 7-8 months, and a female between 8-9 months (Table 2). Infanticide was the cause of death for one infant; two infants died while crossing a high voltage power line; and the exact cause was not known for two infants.

Troop KII: A total of 17 births (four females and 13 males) were recorded in troop B, of which only nine infants reached the age of 12 months. Infanticide was the cause of death in seven cases; four died before the age of the three months; and three at the age of eight months. Also, one infant died while crossing a high voltage power line at the age of 11 months (Table 3).

Adult male replacement followed by infanticide has been observed in several species of predominantly one-male troop-living nonhuman primates (see Hausfater and Hrdy 1984) and some social carnivores such as lions (Bertram 1975, Packer and Pusey 1983). Hrdy (1974) based on her study of Hanuman langurs at Mount Abu suggested that males kill unrelated infants in order to induce sexual receptivity in females, so that the killer males could then mate with the females to sire their own offspring. On the other hand, Rudran (1979a, b, in press) based on his study of red howler monkeys suggested that infanticide has evolved as a result of competition for food and this behavior enhances the fitness of infanticidal males and also their offspring. However, in this study, infanticide by adult males was observed to cause severe infant mortality since 11 out of 41 langur infants born in three troops were killed by invading males. The infanticidal males did not show any sexual discrimination and were seen to kill five female infants and six male infants (see Agoramoorthy and Mohnot 1988 for details). Although some older infants (eight months old in three cases) were killed by adult male invaders, younger infants were main targets because 72.7% of cases the infants were less than five months old. It appears that younger Hanuman langur infants were extremely vulnerable for infanticidal attacks. According to Rudran (in press), the victims of infanticide can be young as well as older infants. Furthermore, killing of older infants in three cases here indicated that vulnerability rather than age is the key determinant of death, as reported previously for the red howler monkeys (Agoramoorthy 1992, Rudran in press).

November 26, 1993 G. AGORAMOORTHY
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3. RUSTYSPOTTED CAT (*FELIS RUBIGINOSA* GEOFFROY) SIGHTED NEAR UDAIPUR

Udaipur has a lake called Fateh Sagar with a road around it called Rani Road. The city is surrounded by hills and two of the big hills called Neemach Mata and Thoria Magra are under the forest department.

On 26th July 1992 at about 6.30 p.m. while driving on Rani Road, my daughter drew my attention to a dead cat lying near the road. I parked my vehicle and examined the animal. It was a small cat, probably killed in a road accident. The body was swollen apparently the cat had been killed about 20 hrs earlier. Its coat was grey with a light reddish tinge, with four dark brown stripes running from the forehead to a little beyond the shoulder dorsally. The flanks and other parts of the body had rusty spots. On the hind quarter the size of the rusty spots was smaller than that on the forelimbs. The tail had no spots or marking. The chin and the underside of the forearms had dark brown stripes. The underside was white with black spots. I consulted "THE BOOK OF INDIAN ANIMALS" by S.H. Prater 1990 and found it to be a rusty spotted cat.

To the best of my knowledge this is the first sighting of a rusty spotted cat from Rajasthan.

July 2, 1993 RAZA TEHSIN
38, Panchwati, Udaipur 313 001.

4. OCCURRENCE OF THE LEAF-NOSED BAT *HIPPOSIDEROS LANKADIVA* KELAART (MAMMALIA:CHIROPTERA:RHINOLOPHIDAE) IN RATNAGIRI DISTRICT, MAHARASHTRA

While working on the breeding biology of the Horseshoe bat, *Rhinolophus rouxi* Temminck, a bat collection trip was organised at Sangameshwar (17° 10′ N, 73° 30′ E) in Ratnagiri district of Maharashtra state in June 1990. Sangameshwar is a town on the Shastri river about 20 miles from the coast. Bats were collected using mist nets which were set on the river bank. In all 220 bats were captured in two mist net operations of which, 80 males and 110 females were identified as *R. rouxi* and 8 males and 22 females were identified as Leaf-nosed bat, *Hipposideros lankadiva.* Of the total collection, four pregnant females of each species were collected for laboratory studies and the rest were released. On further survey by Kothari, a colony of about 200 bats of *H. lankadiva* was sited in the old Shiva temple which is situated on the western bank of the river Shastri. The identifications were confirmed by Muni using the BNHS collections.

According to authoritative literature *H. lankadiva* is known from Garo Hills, Assam (Kemp 1924); Gersoppa, Kanara (Ellerman and Morrison-Scott 1951, Wroughton 1913, Brosset 1962); Kolar, Eastern Mysore (Ellerman and Morrison-Scott 1951, Ryley 1913); Mundra, Sagor, Central Provinces (Ellerman and Morrison-Scott 1951, Wroughton and Ryley 1913a; BNHS collection); Talewadi, Belgaum (BNHS collections); Sohagpur, Hoshangabad, Bihar (Brosset 1962);

Mandu, Indore (Brosset 1962, BNHS collections); Vijaynagar, Bellary (Brosset 1962, Wroughton and Ryley 1913b) and Chandrapur district in Maharashtra (Bhiwagade 1978).

Brosset (1962) in his paper on bats of central and western India mentions that there is no record of this species from Gujarat and Maharashtra. However, Bhiwagade collected six female bats of the same species from Chandrapur district, Maharashtra, in 1978. There is no further record of this species from any other parts of Maharashtra. This is hence the first record of the Leaf-nosed bat, *H. lankadiva* from Sangameshwar, Ratnagiri district, Maharashtra State.

July 15, 1993

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5. WILD BUFFALO *BUBALUS BUBALIS* IN DHAKUAKHANA, LAKHIMPUR DISTRICT OF ASSAM

Dhakuakhana Sub-division of Lakhimpur district in eastern Assam is entirely on the flood-plain zone of the Brahmaputra and its tributary, the Subansiri. The original natural vegetation comprised mostly of tall elephant-grass and patches of marshes and woodland here and there — favoured habitat for the rare Asiatic Wild Water Buffalo (*Bubalus bubalis*). However, the bulk of the woodlands have vanished while the grassland is extant as patches only.

During my stay at Dhakuakhana from November 1989 and April 1991, I made a detailed survey of the whole sub-division and found that the buffalo has vanished from the whole area except one.

On 24 October 1990 a villager of Dakhingaon-Keseruguri reported that four wild buffaloes were in the grassland lying to the west of Lamugaon and south of his village. On the basis of this report I made a thorough survey of the area on elephant-back. We located footprints near Alotiagora village and then following track amidst dense elephant-grass found four buffaloes (date : 26 October, 1990). One large adult female (pregnant), one more adult female, one sub-adult male and one sub-adult female comprised the herd. The bull of the herd, which had one horn was killed sometimes in 1988 near Sariahni village by the Mising tribe. This is the last herd and also the remnant of the wild buffalo population in the whole sub-division. The herd size is now five with the large cow delivering a calf during the winter of 1990-91.

The buffaloes of this area used to move upto Kadam RF on the west bank of the Subansiri river. But now the movement has almost ceased. The wild ones reportedly visit their domestic cousins in the nearby villages during night. How-

ever, during the survey I noticed that they maintain a distance from the domestic stock. While the domestic buffaloes were seen grazing in the peripheral areas, the wild ones restricted themselves to the thick and impenetrable elephant-grass jungle.

The wild buffalo was well distributed throughout Dhakuakhana. The main reasons for decline were:

i) alteration of habitat for cultivation, mainly winter crops; (ii) hunting by the Mising (formerly plains Miri) tribe for food; and iii) attack by rinderpest in mid-1970s.

Before the rinderpest, an estimated 100-150 buffaloes were in the present area which extended upto Basudeo Than, Lesera and the proposed Bordoloni Sanctuary. It vanished from the Bordoloni area in the early eighties. One more buffalo habitat was available along the banks of the Brahmaputra river. The *chapories* (sandy islets and tracts) with tall grass provided ideal home for some scattered herds, which were sometimes augmented by arrivals from Majuli (Jorhat) and Dibrugarh areas. The last wild buffalo of the *chapories* was killed by the local Misings in 1984 at Bahir Bogori, near Tekeliphuta. It was a fine specimen (male) and its horn is now in my collection. The only other area where the buffalo is rarely met with, even today is the banks of the Subansiri river near Bebejia. Here the stragglers come from Kadam RF.

The future of the wild buffalo in Dhakuakhana is bleak. With only five animals surviving, that too in an area surrounded by villages and domestic stock, it is only a matter of time to declare it as 'locally extinct'. However, I submitted a proposal to the Government with clearence from the local administration, for a small sanctuary, namely the Borkalia Wildlife Sanctuary (4.6 sq. km) which will help this remnant buffalo population to recover for the time being and will also protect some wintering water fowls.

My thanks go to Padma Dihingia and Lankeswar Pegu for their help during the survey.

April 30, 1993 ANWARUDDIN CHOUDHURY
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6. SIGHTING OF CHRISTMAS ISLAND FRIGATE BIRD (*FREGATA ANDREWSI* MATHEWS) IN THE ANDAMANS

On 13/11/89 an unusual bird with long wingspan and forked tail was seen at 14-30 hrs., soaring initially low and later going very high in increasing circles, at Rangat Bay jetty, in Middle Andaman (approximately 12° 30′ N and 93° E). Immediately a photograph was taken (200 mm, Nikon) for confirming the bird later on, along with a sketch and notes on special features. The bird was identified with the help of description and pictures given in the book "SEA BIRDS-AN IDENTIFICATION GUIDE" by Peter Harrison, as a juvenile of Christmas Island Frigate bird (*Fregata andrewsi*). This bird is restricted to Christmas Island (Indian Ocean) south of Java *c.* 11° S. No previous authentic record has been made from Indian waters, as stated by Salim Ali and Ripley in their book HANDBOOK OF THE BIRDS OF INDIA AND PAKISTAN (1983).

The juvenile of Christmas Island Frigate bird differs from first stage juvenile of Lesser Frigate bird in white belly and broader breast band; while its differentiation from juvenile Great Frigate bird is more difficult, but that species lacks white on axillaries.

This record was made soon after a severe cyclonic storm hit Middle Andamans in the early morning of 6th Nov. 1989, indicating this vagrant was carried by the cyclonic winds to the east coast of Andamans.

December 16, 1991 AJAI SAXENA
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7. SITE-FIDELITY TO THE UNUSUAL NESTING SITE OF BRAHMINY KITE *HALIASTUR INDUS* (BODDAERT)

Site-fidelity to the wintering and breeding sites have been well established in migratory waterbird species. At Point Calimere the brahminy kite's *Haliastur indus* resident population is augmented by seasonal migrants. As the peak population coincides with the breeding season, a portion of the migrants can be called as breeding migrants to Point Calimere. The unusual nesting site of brahminy kite on the ground at Point Calimere was reported by Morrison *et al.* (1992, *J. Bombay nat. Hist. Soc. 89:* 117-118). The above nest with two eggs was located under a *Prosopis chilensis* cover, and later the eggs were predated. Then the *P. chilensis* bush (ground) was cleared by Chemical and Plastics India Limited (Chemplast) company while repairing the reservoir bund. During 1991 also in the same site (the *P. chilensis* had grown to one metre height) the brahminy kite (probably the same) built the nest and laid two eggs which were also later preyed upon. This observation was again done by two of the three observers (S. Balachandran and Lima Rosalind).

Again in 1992, a nest with two eggs was noticed on 22nd February about 20 m away from the old nest site. As there is no trace of *P. chilensis* growth in the same site, they nested in a partially dried *Suaeda* bush about 40 cm height from the ground. The bush was covered with dried twigs of *P. chilensis* and *Suaeda*,and lined with small pieces of dried mud. As no other nest was observed on the ground at Point Calimere, the breeding pair may be the same one showing strong fidelity to their nesting site. Inspite of the predation twice in three breeding seasons. The reason for preferring this unusual site is not clear.

May 7, 1992

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8. ADDITIONS TO THE BIRDS OF ASSAM: WHITE-TAILED SEA EAGLE AND LARGE SAND PLOVER

Whitetailed Sea Eagle (*Haliaeetus albicilla* Linnaeus)

On 8th February, 1990 while surveying the *chapories* (sandy islets and tracts) off Matmora in Lakhimpur district of Assam, I saw a large dark brown eagle. However, four goosander or common merganser (*Mergus merganser*) on the shingle banks of a small sandy islet diverted my attention for some time. When the goosanders left the area, because of my presence I concentrated on the eagle which was then soaring overhead. The most interesting feature I noticed was its wholly white tail. To view it closer I used a pair of 20 x binocular, and focused on its white tail.

The wings were dark brown from below with head and upper breast lighter (light yellowish brown as seen in bright sunlight). The size of the bird was about that of Pallas's Fishing Eagle (*Haliaeetus leucoryphus*). Later on I again saw the bird in flight when I tried to photograph it (without success). It was undoubtedly a Whitetailed Sea Eagle (*Haliaeetus albicilla* Linnaeus), and happens to be the first record as for NE India -- in fact, east of Nepal.

Large Sand Plover (*Charadrius leschenaultii* Lesson)

On 28th January, 1990 one was spotted on the border of Lakhimpur and Jorhat districts. Inland records in the Indian subcontinent are possibly of passage migrants only. The status of the bird in Assam remains to be determined.

February 28, 1992

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9. OCCURRENCE OF THE EASTERN MARSH HARRIER *CIRCUS AERUGINOSUS SPILONOTUS* KAUP IN CORBETT NATIONAL PARK: A RANGE EXTENSION

During March 1992, a juvenile Eastern Marsh Harrier *Circus spilonotus* was observed in Corbett National Park in northern Uttar Pradesh (29°31′ N, 70°41′ E). The harrier was frequently seen for 5/6 days quartering the open grasslands of the Dhikala Chaur and along the Ramganga river in the Park. Its identity was confirmed later by William S. Clark through photographs. Once treated as a race of the Western Marsh Harrier *Circus aeruginosus*, it is now considered a separate species (Amadon and Bull 1988, Howard and Moore 1991). The forests of the north central Sivaliks and Terai which were once contiguous are today disjointedly so with the forested foothills and Duars of the North-east, facilitating east to west movement of avifauna. The species breeds in the eastern central Asian steppes and winters in the Orient and Eastern India (Brown and Amadon 1968). It has not been previously recorded west of Assam (Ali and Ripley 1978). Therefore, the sighting in Corbett signifies an important range extension and the first record for the park. However, it needs to be determined over a period of time whether the species is a vagrant or a regular winter visitor to the north central Sivaliks. Two additional sightings in the Andaman Islands and at Periyar Tiger Reserve in Kerala (Eames 1991) need further confirmation and would greatly extend the southward range from the main north-eastern wintering grounds. Special thanks to Dave Ferguson of the U.S. Fish & Wildlife Service which funded the BNHS raptor project for infrastructural support, Mr R. S. Bhadauria, I.F.S., C.C.F. U.P. (Wildlife) who readily gave permission for field work and Mr A. S. Negi, Field Director, Corbett, who provided all facilities and to William S. Clark.

January 22, 1993 RISHAD NAOROJI
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10. LONGEST LONGEVITY RECORD FOR THE LESSER SANDPLOVER *CHARADRIUS MONGOLUS* PALLAS

Among the waders, the lesser sand plover is one of the most abundant winter visitor to India. In south India about 8000 individuals have been ringed by the Bombay Natural History Society's Bird Migration Project. At Point Calimere (10° 18′ N; 75° 51′ E) ringing waterbirds has been carried on for the last 12 years. Previously ringing was done between 1969-1973. A few individuals of some species ringed between 1969-73 were retrapped between 1980-82. After that in 1990 and 1991 two lesser sand plover ringed in 1970 and 1971 at Point Calimere were retrapped after 18 and 20 years respectively. The details are as follows:

Ring No.	Date of ringing	Date of recapture	Time interval
AB 57508	24-11-1971	31-1-1990	18 years
AB 49238	29-11-1970	5-1-1991	20 years

As there is no previous published record on the longevity of this species, it is a very interesting longevity record for the wader researchers. Being eastern species, the lesser sand plover and

greater sand plover *Charadrius leschenaultii* have not been studied extensively, as they migrate along the Australasian flyway which has not been monitored earlier. Other related species such as kentish plover *Charadrius alexandrinus*, little ringed plover *Charadrius dubius*,and ringed plover *Charadrius hiaticula* have been studied extensively along the East Atlantic flyway and their longevity have been documented based on the ringing and recapture dates. However, the recorded longevity period for the above three species is about 10 years (Cramp and Simmons 1983, THE BIRDS OF THE WESTERN PALAEARCTIC, Vol. 3.). Hence, the present longevity record of 20 years for the lesser sand plover is the longest among all the plovers.

May 7, 1992

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11. SIGHTING OF LITTLE GULL *LARUS MINUTUS* PALLAS AT BHAVNAGAR NEW PORT, GUJARAT

Since the late Dr Salim Ali reported seeing flocks of *Larus minutus* (*JBNHS* 71: 609-610) in the Great Rann of Kachchh, in 1956, 1957 and 1960, we have come across them [10 km, SE. of Bhavnagar City (21° 46′ N, 72°11′ E)] on January 12, 1992. Three individuals of these birds in a flock of Brownheaded Gulls, *L. brunnicephalus* were seen. They were half the size of the Brownheads, and had a black bill, an indistinct spot behind eye, light grey on the wings and white on rest of the body.

This gull is an accidental vagrant to the Indian subcontinent, there being only one specimen collected by Walter Koelz from Ladakh.

May 22, 1992

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12. DUETTING IN THE GREAT HORNED OWL, *BUBO NIPALENSIS* HODGSON (STRIGIFORMES: STRIGIDAE)

(*With a text-figure*)

While staying at Nagarahole National Park, Karnataka from 7-13 February 1990 the senior author had the opportunity to record owl calls which were made intermittently near his bungalow almost every night. The calls were recorded around 0300 hours on 8 February with a Sony Walkman Professional Model WM-D6 and an ECM- 929LT stereo microphone. On listening to the recording the next morning I was surprised to find that the three note call had a distinctive stereophonic effect with the first and third notes being of lower amplitude than the middle note, which came from a different direction. A total of 10 calls were recorded, 7 consisted of three notes, and 3 consisted of single notes. The single note calls are identical to the first element of the three note calls. It seems quite clear on listening to the recording that there are two owls vocalizing, although this was not apparent to my unaided ear when initially recording the owls. The single calls appear to be "prompting calls" or unanswered duets; our interpretation of the recording is as follows: when bird B answered the first note, bird A always produced the third note of the sequence.

To examine spectral and temporal features, we analyzed the calls with a Kay Elemetrics DSP 5500 Sona-Graph. Notes one and three of the seven hypothesized duets were similar in amplitude and frequency, while the intervening note was always louder and of lower frequency

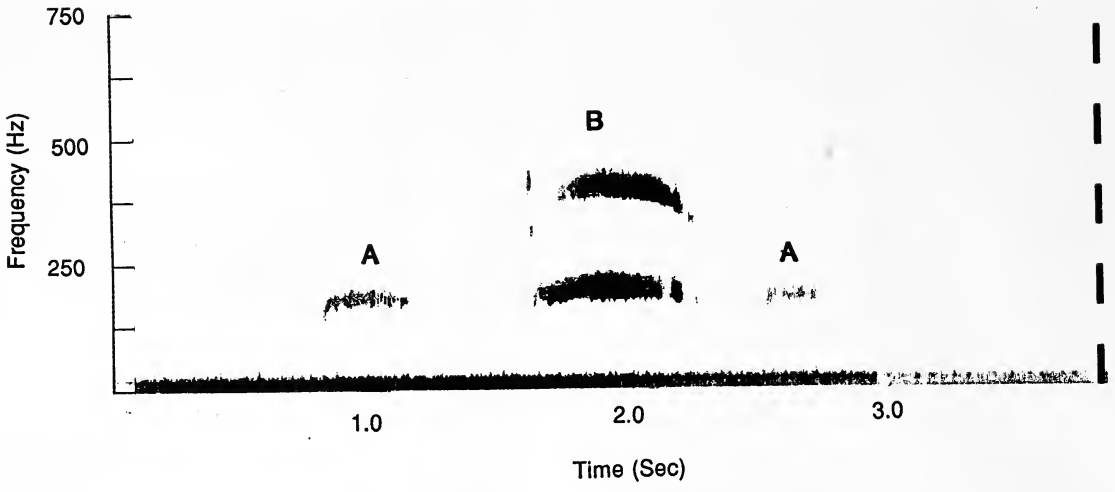

Fig. 1. Difference in amplitude and harmonics of the A and B notes hypothesized to represent two different birds.

(Fig. 1). The duration of the first and third notes was also similar [mean and range, 0.39 (0.38-0.41) and 0.38 (0.32-0.42), respectively], while the middle note was nearly twice as long [mean and range, 0.71 (0.70-0.73)]. The intervals between the calls differ. The interval between the first and second calls was longer and more variable [0.55 (0.38-0.87) than the interval between the second and third notes 0.17 (0.10- 0.22)]. If both owls were vocalizing at about the same amplitude, then bird B was closer to the microphone. With this spatial arrangement, the only way the interval pattern described above can be generated is for the two owls to differ in their response time — owl A responding more rapidly to B's call then B responds to owl A. This circumstantial evidence for duetting in the Indian horned owl remains to be verified by sight records of duetting birds.

The recording was examined by Dr Joe Marshall (ret. Fish & Wildlife Service) who identified the species as *Bubo nipalensis*, and who sent a copy of the recording to Dr John William Hardy (Florida State Museum, Gainesville). We thank Dr Marshall for his assistance.

June 24, 1992 CHRIS WEMMER
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13. A GREY SHRIKE *LANIUS EXCUBITOR* LINNAEUS KILLING A FULL GROWN LITTLE BROWN DOVE *STREPTOPELIA SENEGALENSIS* (LINNAEUS)

On 15 March 1992, while walking along a forest path in Sariska Tiger Reserve, I saw a Little Brown Dove *Streptopelia senegalensis* feeding on the ground near some bushes. A Grey Shrike *Lanius excubitor* suddenly pounced on the dove and pinned it to the ground. I was not able to see, how the shrike held the dove, as the shrike partially covered the dove with its slightly spread-out wings. The dove tried hard to get away, beating its wings desperately and rolling this way and that, to shake off the shrike's hold but the shrike tenaciously clung on to the dove.

Soon the dove stopped struggling. The shrike kept its hold for some more time and then started plucking the dove, looking up now and then. After plucking feathers for some time, the shrike

flew away leaving the prey back.

I waited for half an hour but the shrike did not return. No other predator or scavenger was seen. The feathers from the head, neck and breast had been plucked and there was a curved, incised, wound 8 mm x 1 mm on the back of the head. Apparently it had died from the head wound caused by the sharp beak of the shrike piercing the skull and injuring its brain. I left and returned after about two hours. The dead dove had disappeared.

Salim Ali and S. Dillon Ripley (HANDBOOK OF THE BIRDS OF INDIA AND PAKISTAN, compact edition 1983, page 344) while describing the food of the grey shrike *Lanius excubitor* Linnaeus mention "young or sickly birds (full-grown lark and young Brahminy Myna recorded); known to attack a wounded sandgrouse." In this event the Grey Shrike caught and killed a full-grown, adult dove.

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14. RUFOUSBACKED SHRIKE (*LANIUS SCHACH* LINNE) FEEDING A STRIPED KEELBACK (*AMPHIESMA STOLATA*) TO CUCKOO (*CUCULUS CANORUS* LINNE) FLEDGELING

On the 22nd of September, 1991 while watching birds in the New Forest Campus in Dehra Dun I was attracted towards squeaking calls from the compound of a house. Closer observation revealed a young Cuckoo perched on the bare branch of a mango tree some 3 metres above the ground. The presense of a white nuchal spot helped in the identification of the Cuckoo as *Cuculus canorus.* The squeaking calls were feeding calls and in no time a Rufous- backed Shrike arrived and perched by the side of the Cuckoo fledgeling. The Cuckoo responded by increased squeaking, fluttering of wings, and opening the gape which was conspicuously orange on the inside. The shrike fed the Cuckoo fledgeling nearly twice its size with a small insect and flew off. After 3 minutes the shrike returned with a striped keelback about 25 cm long in its beak.

The Cuckoo fledgeling solicited with its usual zeal, and in no time the dead snake was passed on to it by its foster parent. The Cuckoo having a fairly long prey dangling from its beak behaved nervously, shook it many times and also tried to hit it on the branch. While doing so the snake fell from its beak into the tall grass. The Shrike which was watching the scene dived immediately to the ground and retrieved the snake. The Cuckoo once again dropped the snake. The shrike retrieved it again and offered it to the Cuckoo chick. After shaking it a little the Cuckoo started swallowing the snake head first and devoured it completely inside in two minutes.

May 27, 1992 DHANANJAI MOHAN
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15. PHILIPPINE SHRIKE *LANIUS CRISTATUS LUCIONENSIS*, A REGULAR WINTER VISITOR TO SOUTH INDIA

The status of the Philippine shrike *Lanius cristatus lucionensis* in India had been stated by Ali and Ripley (1983) as a winter visitor to Andaman and Nicobar islands. It is recorded in Sri Lanka, but the status is not yet clearly known. However, they suggested that the population of this species occurring in Sri Lanka reaches through Andaman and Nicobar islands. Apart from Andaman and Nicobar islands it is also recorded from Kerala. At Point Calimere the occurrence of the Philippine shrike has been confirmed by ringing more than ten individuals during October 1991. We believe that this species has been overlooked for many years, though it can be easily differentiated from the brown shrike *Lanius cristatus cristatus.* The differences in the plumage characters were taken as variation due to difference in age. The species was also recorded in Sriharikota island which is situated further north along the east coast (Mohapatra and Santharam 1992). It is evident from the number of birds of both the species ringed, that the population of the Philippine shrike wintering at Point Calimere is almost equal to that of the brown

shrike. In south India these two species have been recorded both along the east and west coasts. The Philippine shrike can be considered as a regular winter visitor to India as is the brown shrike. Peak populations for brown and Philippine shrikes was observed during their autumn passage which indicate that the wintering population of Sri Lanka may pass through Point Calimere also.

It also supports the suggestion made by Ripley (1982), that the brown shrike which breeds in the Khasi Hills and North Cachar may be the subspecies *L. lucionensis.*

May 7, 1992 S. BALACHANDRAN
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16. COMMON MYNAS DRINKING SEA WATER

On Fregate Island (202 ha), Seychelles, between 31 January and 12 February 1992, pairs and small parties of Common Mynas *Acridotheres tristis* (Linn.) fed regularly on the beach, both on sandy beaches and on beach limestone within the lagoon when exposed at low tide. The identity of the food items taken was not determined but the feeding methods used by Mynas suggested that a diversity of food types was taken: Mynas picked food items from the surface of the limestone, pried under stones, turned over seaweed and chased or pounced on presumably more mobile prey.

During these studies maximum temperatures reached 34°C each day and during the hottest part of the day (approximately 1100 h to 1500 h), Mynas that were feeding on the shore were regularly seen to drink from small pools in the beach limestone. Between feeding bouts, birds walked to the edge of these pools, lowered the beak into the water and then lifted the head in typical "dip and tilt" (Campbell and Lack 1985) drinking fashion. The number of such movements observed within a drinking bout ranged from 1 to 7.

No facilities were available for measuring water teperature or salinity in these pools but while most Mynas drank from pools close to the water's edge, some drank from pools in the upper shore where the water was very warm to the touch and tasted very saline.

The drinking of sea water on Fregate Island took place despite the availability of fresh water in a small river, in rain-water pools and in water troughs and other standing water around a pig sty. I have failed to find reference to this behaviour in the literature on Common Mynas (Ali and Ripley 1972, Sengupta 1982) and while the drinking of sea water is well known in seabirds, which have salt glands enabling them to excrete excess salt (Campbell and Lack 1985), the drinking of sea water by Mynas is surprising since they lack salt glands and might therefore subject themselves to osmotic stress.

July 1, 1992 C. J. FEARE
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17. JUNGLE BABBLER *TURDOIDES STRIATUS* FEEDING ON GARDEN LIZARD *CALOTES VERSICOLOR*

On 12 March 1991 at 1030 h in the Gujarat Agricultural University, Campus, Anand, Gujarat, we saw a Jungle Babbler *Turdoides striatus* (Jerdon) flying low between trees with a dead Garden Lizard *Calotes versicolor* (Daudin) in its bill. The abdominal region of the lizard was already damaged and opened and the tail was missing. As the babbler landed on a tree, other flock mates also followed it and one of them could manage to snatch the prey away. This babbler did not go far but landed on the ground and took position near a tree trunk, protected on the sides by bushy growth of ornamental plants which prevented robbing attempts by conspecifics.

Once settled the babbler broke its unusually large prey into small pieces. It did not make any attempt to tear the prey by holding it between its bill and feet as large avian predators do. Instead it pressed the lizard under its feet, and picked the lizard repeatedly and within 4 minutes the lizard was swallowed in small pieces.

The Jungle Babbler is omnivorous. Mason and Maxwell-Lefroy (1912) had found frogs in the gut of this species in Bihar. There exist only one earlier record of recovery of *Calotes* from the gut of the Jungle Babbler (1 out of 140 gut contents) by Andrews and Naik (1970). Toor and Saini (1986) have reported that Large Grey Babbler *T. malcolmi* also feeds on lizards in Punjab (2 out of 125 gut contents).

May 7, 1992

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18. SOME NOTES ON PIED GROUND THRUSH *ZOOTHERA WARDII* (BLYTH)

The Pied Ground Thrush *Zoothera wardii* is known to be a passage migrant in southern India according to Ali and Ripley (1987) and Karthikeyan (1992) and is known only from a few places in South India. It is known to winter in Sri Lanka.

This species was first seen in a very small shola amidst coffee plantation near Yercaud (11° 46′ N, 78° 13′ E) on 22 February 1992 when two males were seen. One of them was seen near a pool in the shola, while the other was seen flying up to a tree at the edge of the shola.

On 23 February 1992 a male was seen in the coffee plantation rummaging amongst the litter and was almost buried amidst it. The Pied Ground Thrush chased a Whitethroated Ground Thrush *Zoothera citrina cyanotus* which was also foraging near by but tolerated the presence of the Spotted Babbler *Pellorneum ruficeps* which was similarly occupied less than a foot away.

Two sightings of one female on each occasion on 22 February 1992 and 26 February 1992 could not be confirmed due to briefness of the sighting.

These sightings near Yercaud, Shevaroy hills further substantiate Krys Kazmierczak's (1991)

sighting of the species at Yercaud on 28 and 30 December 1990 which happens to be the first record of the species wintering in South India[1].

Later while on a visit to Kolli hills one male Pied Ground Thrush was seen on 8 March 1992. The individual was seen inside a shola which is quite disturbed and near Sholaikadu (11° 18′ N, 78° 21′ E). This happens to be the first record of the species for Kolli hills.

The three sightings, all of them being in February and March along with Kryz Kazmierczak's sighting in December suggest that the species winters in Shevaroy and Kolli hills in South India.

The above observations were made during visits to Yercaud and Kolli hills as part of the Tree Shrew (*Anathana ellioti*) Project funded by World Wildlife Fund — US and coordinated by World Wide Fund for Nature — India (Tamil Nadu State Office).

May 7, 1992

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[1]Reported from Pt. Calimere (JBNHS 87 (2): 301) — *Editors.*

19. A NOTE ON THE REPRODUCTIVE BIOLOGY OF THE SPOTTED POND TURTLE, *GEOCLEMYS HAMILTONII*

The spotted pond turtle, *Geoclemys hamiltonii* is a widely distributed hardshell species in Northern India, Pakistan and Bangladesh (Das 1991, Colour Guide to the Turtles and Tortoises of the Indian Subcontinent). However, little is known about its biology. *Geoclemys hamiltonii* is common at a few localities in the flood plains of the river Brahmaputra such as Kaziranga National Park and Orang Wildlife Sanctuary. Locally this species is referred as *nal dura* (Assamese, nal = reed, dura = hardshell turtle). As part of the Wildlife Institute of India, Dehra Dun and US Fish and Wildlife Service Collaborative Project on Turtles and Tortoises, a survey was conducted in Kaziranga National Park, Assam, during the last week of March 1992.

Intensive survey was carried out for two days (i.e. March 25-26, 1992) in and around *Pubmetakani beel, Azgar camp,* Kokhra Range in Kaziranga National Park. Eighteen specimens of *Geoclemys hamiltonii* were collected of which nine were alive, eight shells and one freshly dead turtle. The sex was identified by the concavity of the plastron and long tail with thick base in male and absence of plastral concavity in female.

The largest specimen recorded was a male having a straight line carapace length (SCL) of 39 cm and carapace width (CW) of 22.5 cm. Among 18 individuals recorded 10 were males and 8 females (1:0.8). This indicates a balanced or slightly male biased sex ratio in the wild for *Geoclemys hamiltonii.*

Mean biometrics of 8 live specimens collected on the survey is given in Table 1. The size records show that both sexes attain equal size or males may be slightly larger.

One freshly dead turtle was obtained from *Pubmetakani beel* and cut open to examine reproductive status. This specimen was a female and measured 32 cm in SCL and had two sets of eggs. One set had twenty six well developed ellipsoidal white eggs. Ten of them measured an average of 43.5 mm (range 41-45 mm) in length, 26.0 mm (25-27 mm) in width and weighed 18.0 gm. Based on the size, shape, weight and texture of the egg shell we presume that these eggs were well developed and ready to be laid within a fortnight.

The other set of 36 eggs, all white in colour and round in shape measuring 10-20 mm were

TABLE 1
MEAN BIOMETRICS OF WILD *GEOCLEMYS HAMILTONII*

Biometrics	Male (n=4)	Female (n=4)	Mean (Both Sexes Combined) (n=8)
Carapace length (cm)	32.5	30.1	31.3
Carapace width (cm)	19.63	18.35	18.99
Plastron length (cm)	28.3	28.03	28.16
Shell height (cm)	12.0	12.08	12.04
Weight (gm)	3275	3037	3156

n = sample size.

undeveloped. This indicates that this species is capable of laying two or more clutches annually. Based on queries, Das (1991) speculated that *Geoclemys hamiltonii* may lay twice in a year. Our observation reveals that this species lays some time in mid April. Laying time of the second clutch and inter-clutch period is not known. The clutch size and size of the eggs is comparable with that of larger roof turtles namely, *Kachuga kachuga* and *Kachuga dhongoka.*

G. hamiltonii is probably the only one of larger freshwater Indian emydid turtles wherein males grow to female size or even larger. In the case of other larger Indian freshwater emydids, the three striped roof turtle, *Kachuga dhongoka*, Painted roof turtle, *Kachuga kachuga* and Crowned river turtle, *Hardella thurjii* males are significantly smaller than females.

The present report is the first record of breeding season, clutch size and sex ratio of the wild population of *G. hamiltonii.* Also, the specimen with SCL 39 cm is the largest size record of this species.

Funds for the field work was availed from the WII-USFWS Turtles and Tortoises Conservation Project sponsored through the Ministry of Environment and Forests, Government of India. We are thankful to the Chief Conservator of Forest (Wildlife), Assam for permission and the staff at Kaziranga National Park for help in the field.

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20. THE DISTRIBUTION OF THE ASIAN BROWN TORTOISE (*MANOURIA EMYS*) IN INDIA AND THE TAXONOMIC STATUS OF SUBSPECIES

(With a text-figure)

The Asian brown tortoise *(Manouria emys)*,the largest of Asian tortoises is widely distributed in Southeast Asian countries. In the subcontinent, it is recorded in Bangladesh and Northeast Indian states, namely Nagaland, Assam and Meghalaya (Smith 1931, Das 1991). Barring one locality record of the Asian brown tortoise in Meghalaya by Das (1991), no reliable record of this tortoise is available in other part of India after Smith (1931).

As a part of the Wildlife Institute of India, Dehra Dun and US Fish and Wildlife Service collaborative Turtle and Tortoise Project's survey programme, North Cachar Hills, Kaziranga National Park, Orang and Nameri Wildlife Sanctuaries in Assam and Namdapha Tiger Reserve, Pakhui, Itanagar, Mehao, D'Ering

Wildlife Sanctuaries in Arunachal Pradesh were surveyed from March 12 to April 25, 1992 for turtles and tortoises.

The Asian brown tortoise was recorded only in Mupa-Lantang Reserve Forest, North Cachar Hills, Assam. Five complete plastrons were obtained from the 'Kasari Dimasa' tribal located inside the Mupa-Lantang Reserve Forest. These tribals name this tortoise as 'Yado' = big tortoise. According to them the Asian brown tortoise is distributed sparsely in the forests of North Cachar Hills. They hunt the Asian brown tortoise for food during 'jhooming' (April-May) when the tortoise take refuge in wet stream beds.

Two subspecies namely, *Manouria emys phayrei* (northern subspecies) and *Manouria emys emys* (southern subspecies) have been reported so far (Das 1991). Also, it is recorded that both subspecies differ in pectoral scute contact in the plastral mid line, i.e. northern subspecies with pectoral scutes meeting in the midline of the plastron; southern subspecies with pectorals not meeting in the midline (Fig. 1).

Five plastrons of this tortoise were recorded during this survey with plastron length 36.5, 38.0, 39.0, 40.0, 41.0 cm respectively. Of these three had characteristics of the southern subspecies. The pectorals of these three specimens were placed 2.5-3.8 cm away from the plastral midline. The other two plastrons had pectorals meeting each other on the midline (characteristic of the northern subspecies). One example of each of the morphotypes is deposited with the collections of the WII-USFWS Turtle project at the Wildlife Institute of India, Dehra Dun.

It is reported that the Asian brown tortoises collected by Anderson in Naga hills of Nagaland possessed examples with characteristics of both subspecies. Anderson believed that both subspecies were taxonomically inseparable (Anderson in Das 1991). The present records which are west of Naga Hills also have both examples. Also, records of intergrade (*emys- phayrei* ?) of this species have been reported further west (in Bangladesh) and south (in Thailand, Das 1991). All these support the

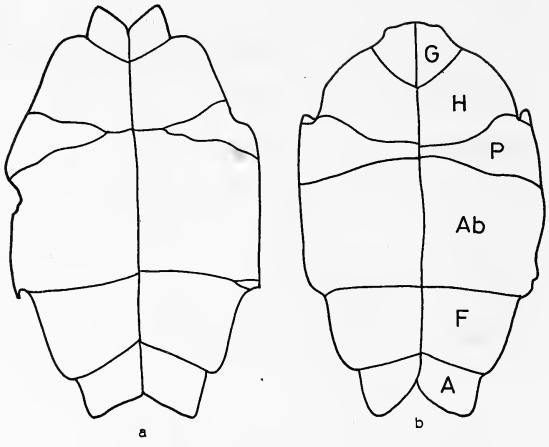

Fig. 1. Plastral scute variation observed in the Asian brown tortoise (*Manouria emys*).
a. Plastron of *Manouria emys emys*; b. Plastron of *Manouria emys phayrei*.
Abbreviations: G– Gulars; H–Humeral; P–Pectoral; Ab – Abdominal; F – Femoral; A – Anal.

view of Anderson as these subspecies lack distinct demarcation in the northwestern portion of the range. Hence, the taxonomic status of the current subspecies assignment of Asian brown tortoise (*Manouria emys*) is doubtful and needs re-evaluation.

Funds for the turtle and tortoise survey in Northeast India was availed from the WII-USFWS Turtle and Tortoise Project. Thanks are due to the Chief Conservator of Forest, Assam for necessary permission and field officials at the Divisional Forest Office, North Cachar Hills, Haflong for help and cooperation for the survey. Also, I am grateful to Mr Moloy Bora, ACS and Deputy Commissioner, North Cachar Hill Council, Haflong for help and hospitality during the survey. I am thankful to Dr E.O. Moll, Eastern Illinois University, USA and to Mr B.C. Choudhury, Scientist 'SE', Wildlife Institute of India (WII), Dehra Dun for going through earlier drafts of this paper and comments. Ms Asha of the WII, Dehra Dun neatly sketched the plastrons of the tortoises.

April 13, 1993

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21. ADDITIONAL LOCALITY RECORDS FOR TWO INDIAN TORTOISE SPECIES

Five species of tortoises have been reported from the Indian subcontinent. They are, 1. Indian starred tortoise (*Geochelone elegans*); 2. Travancore tortoise (*Indotestudo forstenii*); 3. Elongated tortoise (*I. elongata*); 4. Asian brown tortoise (*Manouria emys*) and 5. Afghan four-toed tortoise *(Testudo hosfieldii).* In the subcontinent, the Afghan four-toed tortoise is distributed only in Pakistan. Updated information on the distribution of the Indian tortoises is available in Das (1991). The present note gives specific locality record for the Elongated tortoise and Indian starred tortoise.

Elongated tortoise (*Indotestudo elongata*)

The elongated tortoise is distributed in north and northeast India along the distribution of the sal (*Shorea robusta*) forest. The continued existence of this species in Simlipal Tiger Reserve, Orissa; Saranda Reserve Forest, Chaibassa in Bihar; Jalpaiguri forest and Buxa Tiger Reserve in West Bengal; Garo hills in Meghalaya and Corbett National Park in Uttar Pradesh has been reported (Frazier 1992). But nowhere in India, is the elongated tortoise common. It is listed as endangered in the Red Data Book of the IUCN (Groombridge 1982).

On May 20, 1990, a tortoise was photographed by one of us (SFWS) in Siggudi forest near Kotdwara in the corridor connecting Rajaji and Corbett National Parks. This was later identified as the elongated tortoise, *Indotestudo elongata.* The tortoise was found active on a dried stream bed intersecting the sal forest. The colour transparency is in the collection of WII-USFWS Turtle Project.

This species is reported to be present in Dehra Dun based on a specimen collected before 1970 in Phandowala near Dehra Dun (Frazier 1992). The present record confirms the continued survival of the elongated tortoise in the sal forests of Rajaji National Park. The Rajaji National Park is located at the Northwestern limit of this tortoise's distribution.

Indian starred tortoise (*Geochelone elegans*)

The Indian starred tortoise is widely distributed in semi arid states of India (Das 1991). Mudumalai wildlife sanctuary in Tamil Nadu was surveyed for tortoises during 23-27 December 1991. One complete shell (carapace length 6.5 cm, width 5.3 cm and plastron length 5.5 cm) in the tribal camp in Anaikatty, a plastron in the Irula tribal camp in Moyar and a portion of a plastron in the scrub jungle near Masinagudi was recorded. Subsequently, C.S. Silori has recorded six Indian starred tortoises from January to August 1992. All these sightings were in the scrub jungle near Masinagudi, Moyar and Vazhaithottam in Mudumalai wildlife sanctuary. One shell and three photographs have been deposited in the WII-USFWS Turtle Project collection.

In Tamil Nadu, this species has been reported from Mambakkam, Pudukottai and Ramanad (Das 1991). The present record in the Protected Area, i.e. Mudumalai wildlife sanctuary is an additional locality for the Indian starred tortoise. The highest elevation at which this species has been reported was 450 m at Erinpura, Jalor district in Rajasthan. The present records are at elevations between 850 and 950 m is a significant altitudinal extension in the distribution of the species.

In recent years, the Indian starred tortoise has

been reported in more localities in south-western India such as south east Kerala, Kalakad wildlife sanctuary, Tamil Nadu (Das 1991) and Chinnar wildlife sanctuary in Kerala (Jayson 1993). This indicate that the species probably occurs in many more localities along the rain shadow area of the Western Ghats.

Funds for the tortoise survey in Mudumalai wildlife sanctuary was received from the Wildlife Institute of India (WII) and US Fish and Wildlife Service Collaborative Project on Turtles and Tortoises. We are thankful to the Chief Wildlife Warden, Tamil Nadu and Uttar Pradesh for permission to conduct the surveys. We are grateful to Mr B.C. Choudhury, Scientist SE, WII for going through an earlier draft of the manuscript and offering comments. Mr R. Arumugam, Research Assistant, Indian Institute of Science, Bangalore assisted in the field in Mudumalai wildlife sanctuary.

May18,1993

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22. THE COMMON GARDEN LIZARD *CALOTES VERSICOLOR* (DAUDIN) FEEDING ON GERMINATING SEEDS OF *FERONIA LIMONIA* (LINN.) SWINGLE

Like other agamids the common garden lizard *Calotes versicolor* (Daudin) is primarily insectivorous but also feeds occasionally on small birds, nestlings, frogs and other small animals (Daniel 1983). There is one report of this lizard feeding on unripe, cultivated beans (Daniel and Shull 1964).

Recently, on 4 June 1993, while I was inspecting Narayani (I) Forest Nursery near foothills of the Narayani Forest block of Jhadol Forest Range in Udaipur district, I observed a *Calotes versicolor* digging and feeding on swollen cotyledons of the germinating seeds of *Feronia limonia* in poly-bags. Only those seeds which had just thrown their radicals and whose plumules were about to emerge were taken. The seed coats of swollen seeds were left uneaten.

June 15, 1993

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23. FIRST RECORD OF *MICROHYLA RUBRA* (JERDON) (AMPHIBIA : ANURA) FROM MAHARASHTRA

Microhyla rubra (Jerdon) is a small anuran characterized by elliptical tongue, toothless jaws, stout habit and two shovel shaped metatarsal tubercles. Boulenger (1890) in his *"Fauna of British India"* volume on Reptilia and Batrachia gave the distribution of this frog as Assam, Nellore, Madras Presidency and Ceylon. Inger and Dutta (1986) in their recent overview of the am-

phibian fauna of India, gave the distribution to be Assam, Kerala, Tamil Nadu and West Bengal. Sekar (1991) appended that *Microhyla rubra* is also found in Andhra Pradesh and Karnataka.

We report *M. rubra* from Sangli, Maharashtra. The specimen is in the collection of Western Regional Station, Zoological Survey of India, Pune. (Specimen No. : A/257; Date of collection: 12.9.79; collected by : Dr A.S. Mahabal; Locality : Wasumbe Tank, Vita, Sangli, Maharashtra; Det. by M.S. Ravichandran; snout to vent length : 17 mm).

Small size and fossorial habits (evident from enlarged metatarsal tubercle) are probably responsible for the inadequacy of our knowledge regarding the distribution of this frog. We concur with Daniel (1963) who had pointed out that the species is likely to be more widespread than the collection records indicate. We also agree with Inger and Dutta (1986), that the actual distribution of many species of amphibians of our country is poorly known.

ACKNOWLEDGEMENTS

We thank Dr G.M. Yazdani, Officer-in-charge, Zoological Survey of India, W.R.S. Pune, and to the Director, Zoological Survey of India, for providing facilities.

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24. EFFECT OF SEWAGE WATER ON DIFFERENT SPECIES OF AMPHIBIANS

To study the effect of sewage water on four species of amphibians, namely *Rana breviceps*, *R. cyanophlyctis*, *R. tigerina* and *Bufo andersoni* the present study was conducted at the World Forestry Arboretum, Jaipur from July 1991 to November 1991.

Many cemented tanks have been constructed at different corners in the Arboretum for irrigation and water storage. The domestic sewage water of Jawaharnagar, a suburb of Jaipur city, is first pumped into most of the cemented tanks and then used for irrigation. Only two tanks are used to store fresh water obtained from a tube-well.

During the rainy season, after the first heavy shower (i.e. first fortnight of July) amphibians become active and they move towards water-bodies for breeding. Many of them purposely or accidentally stumble into the tanks. It was noticed that when they fall in the vertical walled tanks, they are unable to come out unless the tanks overflow.

Observations were made in seven sewage water tanks and two fresh water tanks (i.e. control) at about 7 a.m. daily to count the amphibians which died during the preceding 24 hours. As many as 20 to 25 days per month were covered for five months. All the dead amphibians obtained from the tanks were buried daily to clear the tanks for the next day. Data on the dead amphibians are given in Table 1.

A sample of sewage water taken from the main storage tank on 15th Nov. 1991 was sent to laboratory for chemical analysis. Details of analysis report are given below:

(1) pH	:	6.90
(2) Total suspended solids mg/L	:	250
(3) Total dissolved solids mg/L	:	931
(4) B O D (5 days 20°C) mg/L	:	224
(5) C O D mg/L	:	504

TABLE 1
DEATH OF AMPHIBIANS IN TANKS

Months	No. of dead amphibians in tanks							
	Rana *breviceps*		Rana *cyanophlyctis*		Rana *tigerina*		Bufo *andersoni*	
	sewage water	fresh water	sewage water	fresh water	sew. wat.	fre. wat.	sewage water	fresh water
Jul.-Aug.	5	–	–	–	–	–	12	–
Sep.-Nov.	31	–	–	–	–	–	47	–

(6) Sulphate (as SO_4) mg/L : 136
(7) Chloride (as Cl) mg/L : 234
(8) % Sodium : 57.76

It can be concluded from Table 1 and the water analysis report that sewage water is harmful to *Rana breviceps* and *Bufo andersoni*. Both these species are not as aquatic as *Rana tigerina* and *R. cyanophlyctis* but they survived well in the fresh water tanks. Perhaps *R. breviceps* and *B. andersoni* are more prone to exosmosis caused by sewage water. During July and August the concentration of salts in sewage water becomes low due to dilution caused by rainwater. But after the rains are over there is little dilution and *R. breviceps* and *B. andersoni* start to die.

March 27, 1993

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25. NEW ADULT MALE ATTRACTANTS OF DANAID BUTTERFLIES

Earlier Amladi (1975) and Chaturvedi and Satheesan (1979) had reported adult Danaid butterflies visiting *Heliotropium indicum* and *Crotalaria retusa* for pyrrolizidine alkaloids and Monocrotolene respectively. While working on butterflies of Borivli National Park, I came across two plants, *Trichodesma indicum* R. Br. and *Paracaryum coelestinum* Benth. belonging to the family Boraginaceae attracting males of a few species of butterflies.

Trichodesma is an annual herb, much branched, hispid, 45-50 cm tall and bears pale violet blue flowers. Though it emerges during mid June and grows till December. The butterflies, namely *Euploea core* and *Euploea klugii* visit this plant from late August to October. On 23rd August I saw a *Euploea core* hovering around a *Trichodesma* plant and alighting near the top of the plant rather than on the flowers. A closer look revealed that the butterfly had uncoiled its proboscis and was rubbing it on the hispid stem. When disturbed it flew around and returned to the same branch. Till September end main visitors to *Trichodesma* plants were *Euploea's*. Later *Danaus genutia*, *Danaus chrysippus*, and *Tirumala limniace* were also seen visiting these plants and rubbing their proboscis on the hairy stems. In all cases butterflies invariably settled near the apical region of the plant. Individuals of two or three species were also seen on the same plant at a time. The time spent by these butterflies on a plant at a time. The time spent by these butterflies on a plant varied from a few seconds to 8 minutes.

According to Miller and Morris (1988) some *Trichodesma* species are, like the heliotropes, known to contain pyrrolizidine alkaloids. Apparently this may be the reason why males of the Danaid butterflies visited this plant to obtain an important precursor for the male pheromone.

Haribal (1992) has reported Blue Tiger *Tirumala liminiace* and Common Indian Crow *Euploea core* visiting dried plants of *Paracaryum coelestinum.* Subsequently I had also observed *Euploea core* and *Euploea klugii* visiting this plant. *Paracaryum* is an erect branched herb around 1 to 1.5 m high, the stem and branches are red pubescent when young and become glabrous later. The butterflies settled on dried plant and rubbed their proboscis. When disturbed they flew in an area of around 4 m and returned to the same spot.

July 14, 1993 NARESH CHATURVEDI

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26. *ONTHOPHAGUS UNIFASCIATUS* F. (COLEOPTERA: SCARABAEIDAE: SCRABAEINAE) — A NEW RECORD FOR ANDAMAN ISLANDS

The Andaman and Nicobar Islands situated in the North- Eastern Indian Ocean between 6° and 14°N latitude and 91° and 94°E longitude have not been well surveyed for their dung beetle fauna. The islands characterised by tropical moist forests were peopled by hunter-gatherers till 'modern' man came to these islands in 1858 (in addition to an earlier short interlude between the years 1789-1796) and began clearing prime forests for settlement and for agriculture. Since then only five species of dung beetles, namely *Catharsius molossus* L., *Onthophagus cervus* (F.), *O. orientalis* Har., *Copris spinator* Har. and *Paraphytus andamanus* Arrow, have been recorded from these islands (Arrow 1931). For the first time we are recording the presence of *O. unifasciatus* in South Andaman.

Traps baited with dead snails (*Achatina fulica* Bowdich) and dead rats (*Rattus* sp.) laid in the disturbed secondary forests of Garacharma, South Andaman, as well as light (at night) and dog excrement attracted these beetles. As is to be expected, the beetles were abundant during the monsoon period. In mainland India they were found feeding on cow, sheep and dog excrement as well as the carcasses of crow, frog and the tenebrionid beetle *Platynotus perforatus* Mubrant (Veenakumari 1984).

In South Andaman *O. unifasciatus* was found transporting flat pieces of dog excrement by butting it with its clypeus and forelegs. While this has been noticed with cowdung at Bangalore, India (Veenakumari 1984) this behaviour was most commonly exhibited by *O. tritinctus* in mainland India (Veenakumari and Veeresh 1990).

This is the first record of a coprine from these islands after the publication of Arrow's comprehensive work on the dung beetle fauna of the Indian subcontinent (including the Andaman and Nicobar Islands) in 1931.

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February 8, 1993 K. VEENAKUMARI
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27. OCCURRENCE OF *AFISSA DUMERILI* (MULS.)(COCCINELLIDAE : COLEOPTERA) ON CUCURBITS

The genus *Epilachna* belonging to sub-family Epilachinae and family Coccinellidae is phytophagous and harmful to many crops. The species of this genus recorded on cucurbits in India are *Epilachna dodecastigma* Muls. (Fletcher 1921), *E. delesserti* Guer. (Venugopal and David 1972), *E. implicata* (Nayar *et al.* 1976). During a survey of insect — pests of cucurbits at Kanpur and its suburbs (Uttar Pradesh), *Afissa dumerili* (Muls.), earlier designated as *Epilachna dumerili* by Dieke (1947) was found to damage summer and rainy season cucurbits. The larvae and adults feed exclusively on leaves, flowers and tender fruits of cucurbits. Its principal cucurbit host plant is wild *Cucumis trigonus* Roxb. which serves as disseminating agent of this species. The crops are required to be resown when the pest occurs in seedling stage. This species has been earlier recorded from Nilgiri Hills, Bombay, Bengal, Assam, Sikkim, the Andaman Islands, Burma and Siam (Kapoor 1950).

We are grateful to the Director, commonwealth Institute of Entomology of London for identification of this insect.

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28. A NOTE ON PARHOLASPIDAE KRANTZ, 1960 WITH SUPPLEMENTARY DATA FOR *GAMASHOLASPIS BROWNINGI* (BREGETOVA & KOROLEVA, 1960) FROM INDIA

Parholaspids are close allies of macrochelid mites. Formerly parholaspids were grouped into the subfamily Parholaspinae Evans, 1956 under the family Macrochelidae. Bregetova & Koroleva (1960) erected *Evansolaspis*, a new genus to the subfamily Parholaspinae with *Evansolaspis browningi* as the type species. Krantz (1960) raised Parholaspinae to the status of a family which was later considered as essential by subsequent workers (Marshall 1964, Petrova 1967a). Petrova (1967b) synonymized the genus *Evansolaspis* with *Gamasholaspis* Berlese. Parholaspid mites are little studied in India. They are free-living forms commonly encountered in soil

and litter. They form predominant litter fauna of Tropical Rain Forests in India. A fair collection of parholaspid material has been made during the course of surveys to explore the macrochelid fauna of the forest floor of Namdapha National Park in Arunachal Pradesh in the area of northeast India flanking Burma. A number of known species of parholaspid mites together with many new species await to be reported and described. Here only a report on the habitats and distribution of *Gamasholaspis browningi* (Bregetova and Koroleva) is presented. The collections have been made by me and the material is in the collection of the Zoological Survey of India, Calcutta.

PARHOLASPIDAE Krantz, 1960

Gamasholaspis Berlese

Gamasholaspis browningi (Bregetova & Karoleva, 1960)

Gamasholaspis browningi occurs widely in India. Bhattacharyya (1977) has redescribed the species based on material collected in the Kumaon Himalaya. The following material has been collected from other geographical regions of India. The species also has been collected abundantly from Kumaon Himalaya. Since the redescription is based on Kumaon material, the inclusion of collection data further from the region is excluded to avoid unnecessary repetition.

Material examined: 2 females, West Bengal : Darjeeling, Botanical Garden, 13. xi.1973, ex decaying grasses and leaves; 1 female, Darjeeling, Labong, Hill Cart Road, 14.xi. 1973, under humus; 1 female, Darjeeling, Hill Card Road, 14.xi.1973, ex decaying plant parts; 4 females, Darjeeling, North Point, 14.xi.1973, ex decaying leaves; Meghalaya: Shillong, Umpling, 14.vi. 1974, ex decaying vegetation; 1 female, Sikkim: near Palace, Gangtok, 10.xi.1973, ex grass heap; 2 females, Gangtok, Sundarigaon, 11.xi.1973, ex cultivated soil mixed with pigdung.

Distribution in India: Meghalaya (new record), Sikkim (new record), West Bengal (new record) and Kumaon Hills in Uttar Pradesh.

June 26, 1993 R.K. ROY
C/o Dr P. D. Chetia, Parijat Kutir, Lachit Nagar, P.O. Kadamoni, Dibrugurh 786 001, Assam.

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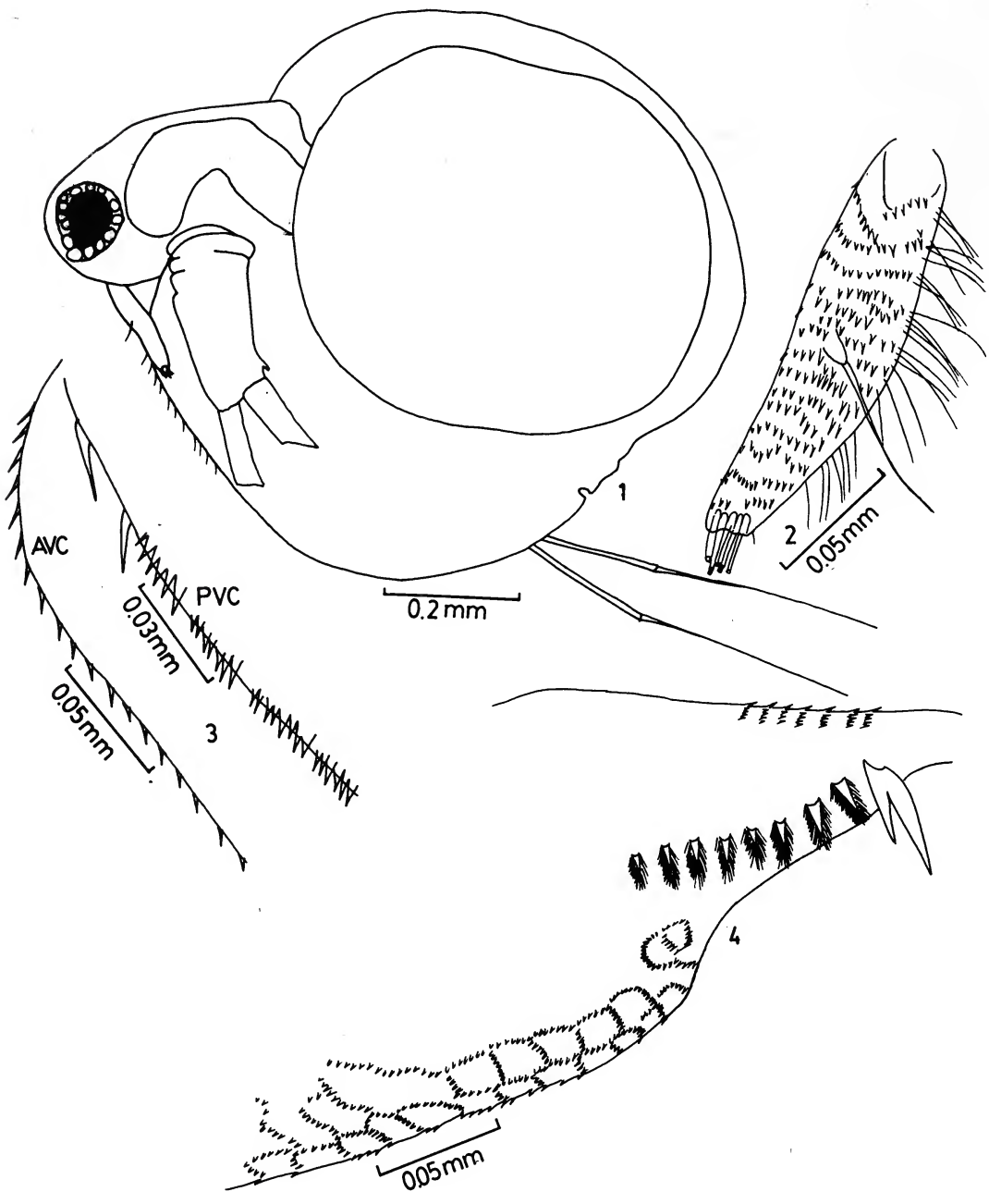
*Not seen in original.

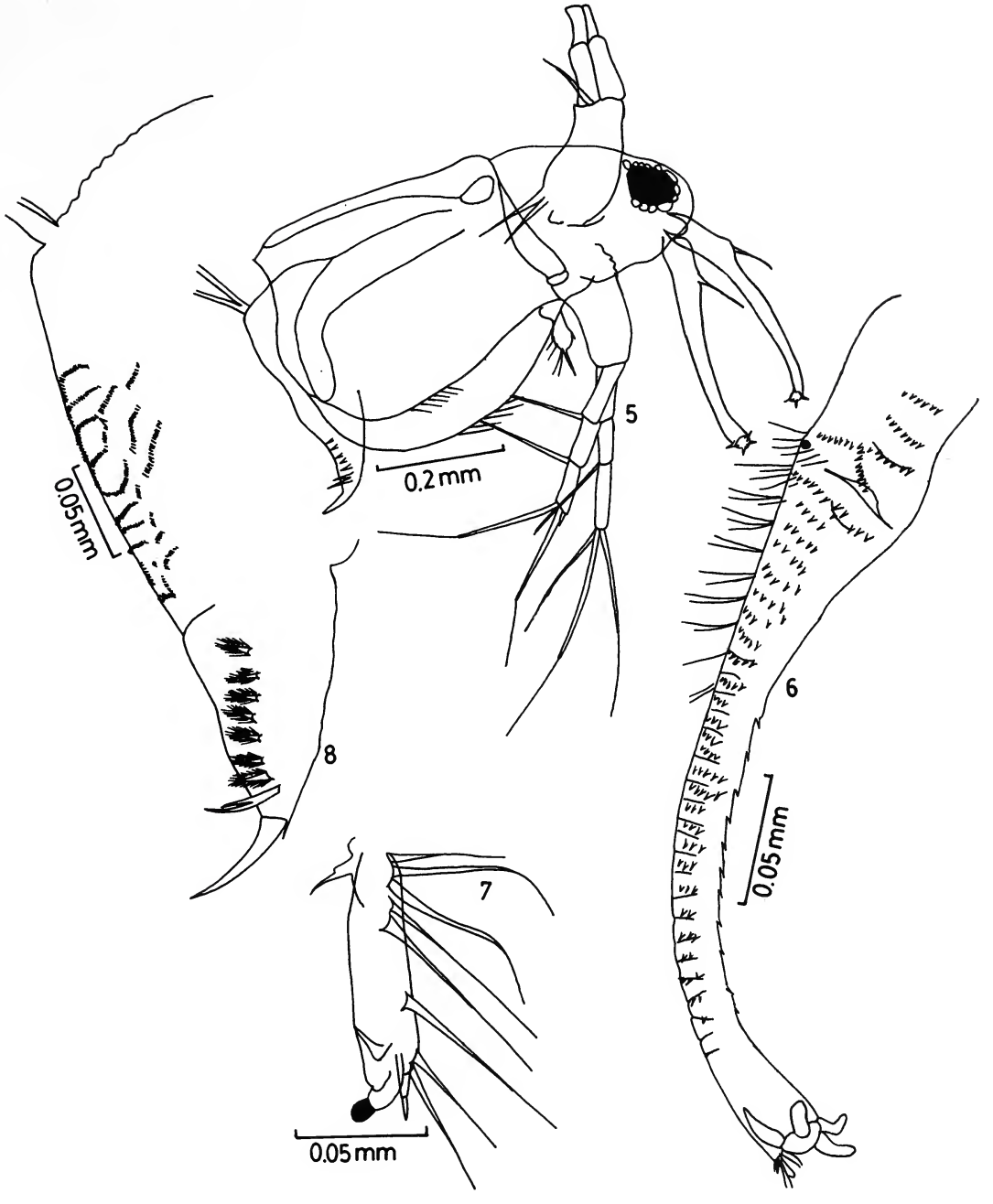
29. *MOINA WEISMANNI* ISHIKAWA, 1896 —A NEW RECORD FOR WEST BENGAL (CRUSTACEA : CLADOCERA)

(With eight text-figures)

India has four species of *Moina* recorded among which *Moina micrura* is considered to be one of the eurytopic species occurring in several habitats. *Moina weismanni* Ishikawa was first reported from India at Mandvi (Gujarat State) by Brehm (1953). There was no subsequent record of this species from India except from Madurai, Tamil Nadu (Venkataraman and Krishnaswamy 1984). During the course of our survey of the wetlands of Hughli District, West Bengal we



Figs. 1-4. *Moina weismanni* Ishikawa – female
1. Lateral view; 2. Antennule; 3. AVC (antero-ventral corner) and PVC (Postero-ventral corner) of the valve; 4. Postabdomen.



Figs. 5-8. *Moina weismanni* Ishikawa – male
5. Lateral view; 6. Antennule; 7. Leg I; 8. Postabdomen.

came across several female and male specimens of *M. weismanni*. The present study shows that *M. weismanni* also occurs in North-Eastern India.

Family MOINIDAE Goulden, 1968
Genus *Moina* Baird, 1850

Moina weismanni Ishikawa, 1896
(Figs. 1-8)

FEMALE: Body size 1.23 mm. The apparent supraocular depression and broadly rounded head are the characteristic features of this organism. The eye is large and is situated near the front margin of the head (Fig. 1). The antennule originates from the ventral side of the head just below the eye, ornamented with rows of small spines and hair-like processes at the posterior margin up to the tip (Fig. 2). Ventral rim of the valves is provided with seventeen to twentyone setae, followed by groups of shorter spines numbering about five to seven and increasing in size posteriorly (Fig. 3). The postabdomen has a row of seven to nine feathered teeth along with a bident tooth on either side. The dorsal surface of the postabdomen is also provided with small spines (Fig. 4). The claw is long with a 'basaldorn' at the proximal region.

MALE: Body size 0.79 mm. Head with a prominent supraocular depression above the eye on the dorsal side (Fig. 5). A pair of antennules are situated just below the eye. Four hooks originate at the tip of the antennule which is a characteristic feature of this species (Fig. 6). First leg has a weakly developed hook (Fig. 7). Shape of the postabdomen is similar to that in females (Fig. 8) except for the presence of vas-deferens.

Distribution: Mandvi, Gujarat (Brehm 1953); Madurai, Tamil Nadu (Venkataraman and Krishnaswamy 1984); Japan (Ishikawa 1896), China (Sieh-Chin and Nan-Shan 1972, Sars 1903) and Cambodia (Brehm 1954).

Remarks: The size of the female varies greatly. Venkataraman and Krishnaswamy (1984) mentioned that the laboratory-fed population grow up to 1.32 mm; however the size of the field population is up to 1.00 mm only. The present material shows the size of 1.23 mm in the field itself. Goulden (1968) reported that variation in size is a common feature for all species of *Moina*. *M. weismanni* can be confused with *M. micrura* which is a commonly occurring species. However, the presence of 4 hooks in the male antennule, structure and the number of spines on the postabdomen and the first leg of male are the important characters which differentiate *M. weismanni* from other species of *Moina* occurring in India.

We are thankful to the Director, ZSI, Calcutta for facilities provided and to Dr S.K. Tandon and Dr N.C. Nandi, ZSI, Calcutta for their encouragement.

May 25, 1993

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30. BURNING OUT THE BLACK DAMMAR, *CANARIUM STRICTUM* ROXB.

The Black Dammar tree *Canarium strictum,* belonging to the family Burseraceae is one of the most strikingly handsome trees occurring in the moist evergreen forests of the Western Ghats. It is quite common between 600-1500 metres in the Anamalai hills. The tree is very large, with a smooth white cylindrical trunk and large pinnate leaves which when very young are velvety crimson, turning rusty tomentose with age. So distinctive is its crown that one could, after little familiarisation, discern the tree from the canopy mosaic even from some distance.

This beautiful tree produces a black resin which could perhaps result in its disappearance. When burned, the resin produces clouds of fragrant white fumes. Its Tamil name is *Karuppu Kungiliam.* The resin is widely used in homes and business establishments, both as a purported mosquito-repellant and a talisman against "evil-eyes". It is extracted by simply burning the base of the trunk. From the burned out bark, the resin oozes out and then coagulates into sticky chunks. the chunks are then sold for anywhere between Rs. 18 and Rs. 25 a Kilo, a significant sum for a tribal.

In course of my fruiting-phenology work in Karian shola and other patches of evergreen forests, I found several of these trees with burned bases. All the adult trees have been burnt at some time or other in the past, and the few young trees show signs of being explored for tapping. Some of the trees are in such bad shape that a good portion of the base has caved in and the part of the trunk still holding the tree is lined with black charred wood. One of the trees leans under its own weight apparently due to the disintegrating base. Even the ones with partially damaged trunks stand a risk of being toppled by monsoon gusts. I found at least one such tell-tale stump in the middle of the forest.

My tribal field assistant Natarajan, as excellent conservation minded naturalist, tells me that the resin can be extracted by merely scarring the bark. The process, although very slow, ensures a supply of resin over several decades without killing the tree, he says. Burning is a shorter and more destructive way of getting a bountiful resin within a span of few years. The heat generated by the fire accelerates the exudation and in no time renders the trunk dry, weak and vulnerable. Evidently this is the same strategy as killing the goose which lays golden eggs.

Extraction of *Kungiliam* has been officially banned in the Indira Gandhi Wildlife Sanctuary since last year. But what future is in store for the trees with already burned trunks? What has been the impact of the burning on the population of these trees along its overall range, i.e. is this species threatened? Natarajan says that the opening of the bark layer paves the way for infection which eventually kills the tree. Surely this is a conservation issue which requires attention.

The status and welfare of the Black Dammar is of relevance to my ongoing study on the conservation of the endangered Great Pied Hornbill. It is well-known amongst biologists who study plant-animal co-evolution that the plant family Burseraceae, to which this tree belongs, along with the families Lauraceae and Palmae, constitute an important source of large-seeded lipid-rich fruits for specialist frugivorous birds like hornbills. This summer, I recovered a *Canarium strictum* seed from the nest excreta of a Great Hornbill. Even a small amount of these fruits, with their nutritionally high quality pulp, could go a long way in meeting the energy requrements of the hornbills. And interestingly the tree's fruiting season coincides with the breeding season of the Great Hornbill, a time when nutritional demands on the parents and young are the highest. My research is just beginning to reveal the role played by the hornbills in the propagation of large forest trees. We see thus, a clear illustration of how the survival of just one tree species can be crucially linked to the well being of the whole community.

June 13, 1992 R. KANNAN

Hornbill Project,
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31. *PEGIA NITIDA* COLEBR. — A NEW RECORD FOR WESTERN HIMALAYA

Pegia Colebr. (Anacardiaceae) with its 8 species is distributed from Eastern Himalaya to South China and Philippines. Only *P. nitida* Colebr. occurs in India which is distributed in Central and Eastern tropical Himalaya, from Nepal extending eastwards to Assam, up to 1200 m.

While identifying the specimens collected during a botanical tour to Mussoorie (Garhwal Himalaya), a few specimens were identified as *Peigia nitida* Colebr. on critical examination at the Herbarium of the National Botanical Research Institute, Lucknow. A review of literature revealed that this species has so far not been reported from Western Himalaya. The present report thus extends its distribution from C. & E.tropical Himalaya westward up to Mussoorie, ascending up to 2057 m.

Pegia nitida Colebr. is a scandent shrub with imparipinnate leaves and obliquely obovoid drupes. It is worth mentioning here its correct name and sysnonyms with citations followed by flowering -- fruiting period, distribution, etc.

Pegia nitida Colebr. in Trans. Linn. Soc. 15: 364. 1827; Hara & Press in Enum. Fl. Pl. Nepal 2: 101. 1979; Deb, Fl. Tripura State 1: 465. 1981; Mukherjee & Chandra in Bull. Bot. Surv. India 25 (1-4): 55. 1983. *Robergia hirsuta* Roxb. Fl. Ind. 2: 455. 1832. *Taparia hirsuta* (Roxb) Hook. f., Fl. Brit. Ind. 2: 28. 1876; Kanjilal *et al.*, Fl. Assam 1(2): 339. 1936.

Fl. : January - March; *Fr.:* April -May.

Distribution: India (Assam, Manipur, Sikkim, Tripura), Nepal, Bhutan, Burma, Bangladesh, China and Philippines.

Specimens examined: Paritibba forest near Woodstock School, Mussoorie, *S.I. Husain & S.L. Kapoor,* 210564, 30-4-1988, fr., 'occasional in the forest' (LWG).

ACKNOWLEDGEMENT

We thank the Director, National Botanical Research Institute, Lucknow, for facilities.

October 5, 1992 BHASKAR DATT
S.L. KAPOOR

Herbarium,
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Lucknow-226 001.

32. THE IDENTITY OF *PHANERA NICOBARICA* (LEGUMINOSAE : CAESALPINIOIDEAE)

Balakrishnan and Thothathri (1975) while describing *Phanera nicobarica* Balakr. & Thoth. as a new and interesting species from the Great Nicobar Island stated "This species belongs to the section *Meganthera* de Wit and approaches near to *P. stipularis* (Korth.) Benth. but differs by its longer and stouter petioles, longer pedicels, oblong-lanceolate petals and ovary with shorter stipe, peltate stigma and many ovules." But in course of a taxonomic study on the Indian Bauhinias examination of the type materials (Balakrishnan and Thothathri did not examine the type of *Bauhinia stipularis* Korth. (= *P. stipularis*) — pers. comm., Thothathri) together with some other relevant specimens from Sumatra: *Forbes* 1793, 2665 & 2928 (all CAL) and Nicobar Islands: *Chakraborty* 3231 (CAL); *Dwivedi* 8020 (CAL, PBL); *Hore* 7238 (CAL); Nair 7192 (CAL, PBL) reveals that none of the aforesaid differences hold good. Hence, *P. nicobarica* has been treated here as a synonym of B. stipularis. The full synonymy is as follows:

Bauhinia stipularis Korth. in Verh. nat. Gesch. Ned. Bezitt., Bot. 92. 1841. Type: Sumatra, *Korthals s.n.* (lectotype L No. 908. 107-1410, photo. of lectotype CAL!; isolectotype K, photo. of isolectotype CAL!). The Leiden specimen was annotated by de Wit as the lectotype in 1951 but has been cited simply as a type in his subsequent publication (1956).

Phanera stipularis (Korth.) Benth. in Miq., Pl. Jungh. 263. 1852. Type as above.

Phanera albo-lutea Miq., Fl. Ned. Ind. 1(1): 1079. 1858. Type: Padangsidempuan, *Teysmann*,H.B. 857 (holotype U, fide de Wit 1956).

Bauhinia albo-lutea (Miq.) Prain in J. Asiat. Soc. Bengal 66(2): 181. 1897. Type as above.

Phanera nicobarica Balakr. & Thoth. in Bull. Bot. Surv. India 17(1-4): 201. 1975; *syn. nov.*. Type: 15 km on East-West road, Great Nicobar, + 100 m, 23 Aug. 1975, *Balakrishnan* 3043 (holotype CAL!; isotype CAL!, PBL); 18 km on North-south road, Great Nicobar, ± 25 m, 17 July 1976, *Balakrishnan* 3824 (paratype CAL!, PBL); on the way from Galathea Bay to Pulobaha Bay, Great Nicobar, ± 125 m, 26-3-1966. *Thothathri & Banerjee* 11661, 10661 typo. err. in protologue' (paratype CAL!).

Bauhinia nicobarica (Balakr. & Thoth.) Bennet in Ind. J. Forest. 5(4): 326. 1982. Type as above.

Note: The paratype specimen (*Thothathri & Banerjee* 11661) of *P. nicobarica* differs from rest of the specimens in having most of the petals with cuneate bases (a character not mentioned in the protologue) in addition to the few subcordate and typical cordate ones. Similar petal-character, i.e. with cuneate bases was also noted by Prain (1897: 182) but he erred in assigning this characteristic to *B. albo-lutea* which is only a synonym of *B. stipularis* (cf. de Wit 1956). This interesting variation in the petal-character requires further observation to find out whether it has any special taxonomic value.

ACKNOWLEDGEMENTS

We are grateful to Prof. Kai Larsen for confirming the identity of *P. nicobarica* and permitting us to publish the matter independently though they (Prof. K. & S.S. Larsen) had realized years ago that *P. nicobarica* is the same as *B. stipularis*. We are also grateful to the authorities of the Rijksherbarium, Leiden and Royal Botanic Gardens, Kew for providing the photographs of the type specimens.

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33. *PARTHENIUM HYSTEROPHORUS* L. (ASTERACEAE) FROM NEIL ISLAND — A NEW ADVENTIVE TO THE ANDAMAN AND NICOBAR ISLANDS

Mikania cordata (Burm. f.) B.L. Robinson and *Chromolaena ordorata* (L.) R.M. King and M. Robinson are the two major weeds of Asteraceae hitherto reported to be growing along roadsides and in forest clearings in the Andaman and Nicobar Islands (Saldanha 1987). *Parthenium hysterophorus* L. yet another member of the family Asteraceae which ranks third among the top seven weeds of the world (King 1966) has been found for the first time — on Neil, a small island situated towards the southern end of Ritchies' Archipelago, Northeast of Port Blair, South Andaman. Even a relatively recent botanical survey of the island did not include *P. hysterophorus* in the list of plants collected from there (Basu 1987).

This species is known to be dispersed mainly through the agencies of water, vehicles and animals. Wind dispersal in this species is highly restricted and is only of the order of a few metres (Auld *et al.* 1982/83). In view of this, inadvertent introduction through the agency of man is perhaps the only explanation for the occurrence of *P. hysterophorus* on so many far flung islands in the Indian and Pacific Oceans. The complete description and other details are given by R.S. Rao, in

the first report of the naturalising of the weed in India.

It is imperative that steps are taken to eradicate the weed at the earliest. It may otherwise pose a threat to the native flora of the islands owing to its allelopathic effects.

Parthenium hysterophorus L., Sp. Pl. 988. 1753; Voight, Hort. Sub. Calcutt. 62. 1845; Rao, in J. Bombay nat. Hist. Soc. 54: 218. 1956.

Voucher specimens of the plant: South andaman: Neil Island: Sharma and Prashanth 101, dated 20-10-1988: deposited in the Herbarium of the Botanical Survey of India, Andaman and Nicobar Circle, Port Blair (PBL).

ACKNOWLEDGEMENT

We are grateful to Dr A.K. Bandyopadhyay, Director, Central Agricultural Research Institute, Port Blair for permission to travel and for constant encouragement.

December 23, 1992

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34. A NOTE ON THE REDISCOVERY OF *JASMINUM ANDAMANICUM* BALAKR. AND N.G. NAIR — AN ENDANGERED ENDEMIC SPECIES

The genus *Jasminum* is a fairly well represented member of the family Oleaceae. Nine species of this genus occur in the Andaman — Nicobar islands of which three species are endemic. *Jasminum andamanicum* Balakr. and N.G. Nair was originally described by Balakrishnan and Nair from the old collections of Dr King's Collector (1894) and Parkinson (1915) at CAL and PBL. These specimens were known to have been collected from the Middle Andamans and South Andamans. After Parkinson's collection (1915) it had never been collected again.

During the floristic survey of Mount Harriet hill ranges, we collected this interesting wild ornamental endemic *Jasminum.* The area from which the species has been collected supports a semi-evergreen type of forest. Mount Harriet hills, the highest peak of South Andamans is rich in plant diversity. About 46.7 sq. km of these hill ranges have been declared as a National Park. *J. andamanicum* is found growing sparsely along the edges of the forests at Shoalbay. This area is not included in the National Park area of the hill ranges. There is every possibility of extinction of this endangered endemic species if proper protective measures for conservation are not taken.

Being an interesting re-discovery, a brief description is given below on the basis of the recent collection:

Jasminum andamanicum Balakr. and N.G. Nair in Bull. Bot. Surv. India 21: 215. 1979.

Scandant climbing shrubs, woody at base, pale greyish or creamy white with fissured bark, young branchlets greenish, smooth. Leaves trifoliolate, opposite, dark green above, comparatively pale green beneath; leaflets 3-10 x 2-6 cm, lateral nerves 5-8 pairs, petiole *c.* 3 cm long, terminal petiolules 0.9-2.2 cm long, lateral petiolules *c.* 4-9 mm long. Inflorescence in paniculate cymes up to 12 cm long, erect, densely matted with white wooly pubescence. Flowers white with pleasant smell, calyx pale whitish,

corolla milky white, stamens bright lemon yellowish.

Specimens examined: South Andamans, Mount Harriet Hills, Shoalbay 19, 14/12/1991, S.P. Mathew 20778 (CAL, PBL) & North Bay Hill Jungle 5/1/1894, Dr King's collector s.n. acc. no. 286073, 28074, 286075 & 286076 (PBL). Middle Andamans 17/121915 C.E. Parkinson 787 (CAL, PBL).

Ecology: Very rare in the edge of the inland semi-evergreen forests.

November 25, 1992

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35. *JATROPHA TANJORENSIS* ELLIS ET SAROJA — A NEW RECORD FOR ANDHRA PRADESH

During the floristic survey of Euphorbiaceae in Andhra Pradesh we collected *Jatropha tanjorensis* Ellis & Saroja from Wankidi in Adilabad district. After perusal of literature and specimens deposited in local and National herbaria it has been confirmed that our collection of *Jatropha tanjorensis* forms a new record for the State of Andhra Pradesh. It was first reported as a new species from Kollemendu in Vedaranyam forest in Tanjore district of Tamil Nadu in South India by Ellis and Saroja (1961, J. Bombay nat. Hist. Soc. 58: 834-836.). Since our collection forms a subsequent collection and since it was not reported earlier from Andhra Pradesh, the up-to-date nomenclature, citation, distribution and phenological data is provided. The specimen collected is deposited in the Department of Botany, Sri Krishnadevaraya University, Anantapur, Andhra Pradesh.

Jatropha tanjorensis Ellis & Saroja in J. Bombay nat. Hist. Soc. 58: 834. 1961; Dehgan & Webster in Univ. Calif. Publ. 74: 64. 1979; Mathew, Mat. Fl. Tamil Nadu carnatic 336. 1981.

Distribution: Along the road sides of the Wankidi forest area in Adilabad district in Andhra Pradesh.

Fl. & Fr.: August - December.

Specimens examined: Adilabad, Wankidi forest, *P.S.P. Babu & D.A. Moulali* 11801.

We thank the authorities of CAL Herbarium for confirming the identity of the specimen.

November 3, 1992

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36. REDISCOVERY OF *CALANTHE WHITEANA* KING & PANTLING— A VERY RARE INDIAN ORCHID ENDEMIC TO CHUNGTHANG VALLEY OF SIKKIM

(With ten text-figures)

During an extensive floristic exploration of floristically rich Chungthang valley of North Sikkim in June 1991, I came across a very rare plant of *Calanthe* R. Br. of family Orchidaceae. On critical examination of the fresh specimens, it was identified *Calanthe whiteana* which was otherwise thought to be extinct or of very rare occurrence (U.C. Pradhan 1979). King and Pantling while describing the plant in 1898, stated the status of the species to be rare and commented that "This is yet a little known plant". Later on many workers tried to find this species in its natural habitat but all attempts proved futile and lead to the conclusion that it might perhaps be extinct. As the specimens have been hitherto collected from Chungthang valley at 1830 m altitude, no one knows the specific type locality of this orchid species. Subsequent to King & Pantling's report in 1898, there is no report on its collection from nature. The present collection from Bop R.F. of Chungthang valley is after a lapse of more than a hundred years and is very interesting.

Figs. 1-10. *Calanthe whiteana* King & Pantling
1. The whole plant; 2. Side view of a flower; 3. Front view of a flower; 4. Dorsal sepal; 5. Lateral sepals; 6. Petals; 7. Naked flower showing column, lip, pedicellate ovary and spur; 8. Longitudinal cross-section of a flower; 9. Anther; 10. Pollinia.

This species is perhaps one of the largest and the most beautiful among all the Calanthes and Horticulturally most attractive orchid species. The whole plant is prominent and stands, majestically among the other herbs and shrubs of the locality spreading its magnificent foliage and prominently bearings its most beautiful yellow fragrant flowers on its long raceme.

As the plant is yet and little known plant, ten text-figures along with the detailed description of the taxon is provided below.

Calanthe whiteana King & Pantling, Orchid Sikkim Himalaya, 174. 1898; U.C. Pradhan, Indian orchids. Guide to identification and culture Vol. II: 259. 1979.

Terrestrial. Pseudobulb 3-4 cm long, conical with 4-5 annular rings, smooth, partially enveloped in 4-5, 7-16 x 6-7 cm, broadly triangular, acuminate, many-nerved sheathing bracts. Leaves 4-6, 60-100 x 6.3-8.2 cm, linear-lanceolate, acute, much narrowed towards sessile base, plicate. Inflorescence 1 or 2, 100-130 cm long, from the sides of the pseudobulb erect, terete, puberulous; the peduncle 60-75 cm long, stout, usually with 2, 10-12.5 cm long, sub-tubular, distantly placed bracts; the raceme 36-54 cm long, slightly angular, with many dense pedicellate ovary 1-1.5 cm long, with slightly twisted grooves, smooth; the floral bracts 1-5.5 x 0.4-0.75 cm, linear lanceolate 7-nerved, acuminate deflexed. Flowers 1.6-2.5 cm long, yellow. Sepals sub- equal, reflexed and resting upon the pedicellate ovary. Yellowsih-green, fleshy, smooth; the dorsal sepal 0.7-0.9 x 0.4-0.5 cm, elliptic-oblong, sub-acute, 3-nerved; the lateral pair 0.7-1. 1 x 0.55-0.6 cm, 5-nerved, elliptic, sub-ovate, sub acute. Petals 1-1.2 x 0.3-0.32 cm, elliptic-lanceolate, acute, narrowed towards hooked base, reflexed and rest upon dorsal sepal, obscurely 3-nerved, pure yellow. Lip *c.* 0.5 cm long and 0.9 cm broad when flattened, adnate to the whole length of column; without lateral lobes; the lamina of apical lobe is transversely elliptic or quadrate and apically bilobulate; the labules reflexed, their margins entire or sub-crenate; the upper surface with 3-5 papillate ridges running along the centre from base to apex, yellow. Column *c.* 0.3-0.4 cm long, stout; the stigmatic surfaces double, one on each side of entrance to the spur. Spur 2-2.4 cm long, sub-clavate, slightly curved, sparcely pubescent the inner wall with hair-like papillae in its upper half. Anther 1.9-2 mm long ovate, dark brown in colour. Pollinia 8, 1-1.6 mm long, unequal, in groups of four, sub- sessile on an oblong gland.

Fls. : May – June.

Alt. : 1675-1980 m.

Specimen cited: Mangan district (Sikkim) : Bop R.F., 6th June 1991, *S.Z. Lucksom* 211 (Herb. Forest Department; Gangtok).

Distribution: Endemic to Chungthang valley of Sikkim.

Population status: Very rare.

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37. ADDITION TO THE GRASSES OF BIHAR – II

During the revision of grasses of Bihar, we came across taxa namely, *Cyrtococcum trigonum* (Retz.) A. Camus, *Heteropogon contortus* var. *polystachyos* (Roxb.) Deshpande, *H. ritchiei* (Hook.f.) Blatt. et McC., *Ischaemum impressum* Hack., *Paspalidium geminatum* (Forssk.) Stapf, and *S. verticilliflorum* (Steud.) Stapf and 7 cultivated taxa namely *Bambusa glaucescens* (Willd.) Sieb. ex Munro, *B. teres* Ham. ex Wall., *B. vulgaris* Schrad, *B. vulgaris* var. *striata*

(Lindl.) Gamble, *Dendrocalamus giganteus* Munro, *Sorghum bicolor* (L.) Moench, and *S. miliiforme* (Hack.) Snowden, which have not been reported earlier from Bihar (Jain *et al.* 1975, Jha and Varma 1993, Jha 1992). The present notes give up-to-date nomenclature, a brief description, distribution, ecology and uses and critical notes wherever necessary for wild plants. The cultivated taxa are enumerated at the end with citation of specimens numbers only. The plants were identified at Bhagalpur University Herbarium and rechecked at Central National Herbarium (CAL). The cited specimens are deposited in Herbarium of Bhagalpur University.

ENUMERATION

Wild Plants

Cyrtococcum trigonum (Retz.) A. Camus in Bull. Mus. Hist. Nat. Paris 27: 118. 1921; Bor, Gr. Burma, Ceylon, Ind. & Pak. 292. 1960.

Perennials. culms upto 50 cm high. Leaf-blades 1.5-8.5 x 0.2-0.8 cm. Panicles upto 15 cm long, lax. Spikelets 1.5-2 mm long, hispid; pedicels shorter than the spikelets. Lower glume 0.7-1 mm long, ovate, pubescent. Upper glume 1.2-1.8 mm long, pubescent. Lower lemma similar to upper glume, epaleate. Upper lemma coriaceous, upto 1.5-2 mm long.

Distribution: INDIA: Bengal, Tamilnadu; Sri Lanka and south-east Asia.

Ecology: On hills; rare. Flowers August to October.

Specimens examined: Chunjo Hills (550 m), *Jha 6508.*

Notes: Bor (l.c.) reported this taxon from Madras and Jain *et al.* (1975) from Bengal. We could collect this grass from Rajmahal Hills where it was growing in association with *Panicum brevifolium* L., *P. notatum* Retz., *Pseudosorghum fasciculare* (Roxb.) A. Camus, and *Microstegium ciliatum* (Trin.) A. Camus. Its occurrence is a new record for Bihar.

Heteropogon contortus var. **polystachyos** (Roxb.) Deshpande in Bull. Bot. Surv. Ind. 30: 121. 1988. *H. polystachyos* (Roxb.) Schult. Syst. Veg. 2. Mant. 460. 1824; Bor, Gr. Burma, Ceylon, Ind. & Pak. 165. 1960.

Densely tufted perennials, upto 1.5 m tall. Leaf-blades 6-35 x 0.2-0.5 cm, linear, sometimes with scattered hairs on surfaces; ligules small, ciliate. Inflorescence spatheate, many (2-8), axillary. Racemes 5-8 cm long; peduncles smooth, glabrous.

Distribution: INDIA: Andhra Pradesh, Gujarat, Maharashtra; endemic.

Ecology: Along railway tracks and hill slopes; rare. Flowers July to December.

Specimens examined: Asanbani, *Das s.n.*

Notes: This taxon is closely associated with *Heteropogon contortus* (L.) P. Beauv. ex Roem. et Schult., and differs only by its inflorescence. The racemes are solitary and terminal in the latter whereas they are many and axillary in the former. Due to close similarity in vegetative as well as in reproductive parts, Deshpande (1980) gave it a varietal status. Our findings also support Deshpande's view.

Heteropogon ritchiei (Hook.f.) Blatt. et McC. in J. Bombay nat. Hist. Soc. 32: 623. 1928; Bor, Gr. Burma, Ceylon, Ind. & Pak. 165. 1960.

Annuals; culms upto 1.2 m high. Leaf-blades linear; sheaths covered with bulbous based hairs; ligules small, ciliate. Racemes 6-8 cm long; peduncles puberulous. Spikelets armed with stiff hairs from tubercle-based bristles.

Distribution: INDIA: Maharashtra, Madhya Pradesh, Karnataka, Nagarhaveli; endemic.

Ecology: Hills and open grasslands; rare. Flowers July to December.

Specimens examined: Asanbani, *Das s.n.*

Notes: Due to small and ciliate ligules this taxon comes closer to *H. contortus* but the former can be easily separated from the latter by the presence of full covered bulbous based hairs on the upper surface of the spikelets.

Ischaemum impressum Hack. in DC. Monogr. Phan. 6: 210. 1889; Bor, Gr. Burma, Ceylon, Ind. & Pak. 180. 1960; Patunkar, Gr. Marathwada 72. 1980; Hemadri, Gr. Junnar 77. 1980.

Annuals, upto 80 cm high. Leaf-blades 6-12 x 0.5-1.5 cm, base sagittate, margins scabrid, with a distinct petiole, upto 4 cm long; ligules upto 3 mm long, membranous. Spikes 2. Sessile

spikelets 6-7 mm long, hermaphrodite. Pedicelled spikelets 6-7 mm long; pedicels hispid along one margins. Caryopsis upto 2.3 mm long, oblong.

Distribution: Mahrashtra; endemic.

Ecology: Along railway tracks; rare. Flowers August to November.

Specimens examined: Bhagalpur, *Jha 7501.*

Critical notes: This grass is reported as endemic to Western India. Recently it has been collected from Bhagalpur (Eastern India). This taxa along with *Themeda quadrivalvis* (L.) O. Ktze has been used as packing materials of grape which comes from Nasik (Maharashtra) and further spreads along railway tracks.

Notes: Leaf-blades with a distinct petiole and sagittate base help to identify this taxa in the field.

Paspalidium geminatum (Forssk.) Stapf in Prain, Fl. Trop. Afr. 9: 583. 1920; Bor, Gr. Burma, Ceylon, Ind. & Pak. 333. 1960.

Aquatic perennials, upto 1 m long. Culms stoloniferous, creeping and floating. Leaf-blades 5-25 x 0.5-1 cm, apex acuminate. Spikes many, 1.5 cm long. Spikelets 2-2.5 mm long. Lower glume 0.5-0.7 mm long, faintly 2-nerved, obtuse. Upper glume 2-2.2 mm long, 7-nerved. Lower lemma male, 2.5 mm long, paleate, 5-nerved. Upper lemma hermaphrodite, 2-2.2 mm long, coriaceous, mucronate; palea similar, muticous.

Distribution: INDIA: Orissa, Bengal, Maharashtra, Rajasthan.

Ecology: In low marshy lands; rare. Flowers September to December.

Specimens examined: Jamalpur, Munger district, *Jha 7225.*

Notes: It shows close resemblance to *Paspalidium punctatum* (Burm.) A. Camus but can be easily identified in the field due to the absence of sharp pointed apex of spike.

Sorghum verticilliflorum (Steud.) Stapf in Prain, Fl. Trop. Afr. 9: 116. 1917; Bor, Gr. Burma, Ceylon, Ind. & Pak. 223. 1960; Patunkar, Gr. Marathwada 110. 1980.

Annuals. Culms upto 1.5 m high, erect, simple; nodes mostly glabrous or sometimes pubescent. Leaf-blades 10-45 x 1-2.5 cm; ligules a rim of stiff hairs. Panicles upto 60 cm long, oblong- lanceolate; primary branches verticillate. Sessile spikelets 4-5.2 mm long, hairy, often awnless, rarely awned. Lower glume 4- 5.2 mm long, dorsally hairy, 7-9-nerved, muticous. Upper glume acuminate, 5-nerved. Lower lemma 4-4.2 mm long. Upper lemma awned or awnless, apex bilobed, awn 1-1.5 cm long. Caryopsis 3 mm long, elliptic. Pedicelled spikelets 5-5.5 mm long, awnless, male.

Distribution: INDIA: Maharashtra, Tamilnadu.

Ecology: In open grasslands and along water courses; rare. Flowers September to December.

Specimens examined: Asanbani, *Das s.n.*

Notes: This annual grass was earlier restricted to South India (Bor, l.c.). Later Patunkar (1980) reported its occurrence from Western India. Now it has spread to Eastern India as well.

CULTIVATED TAXA

Bambusa glaucescens (Willd.) Sieb. ex Munro, Trans. Linn. Soc. Lond. *26:* 89. 1869. *B. nana* Roxb. in Fl. Ind. *2:* 199. 1832.

Specimens examined: Sahibganj, *Jha 6459, 7379.*

Bambusa teres Ham. ex Wall. Cat. 5026 B; Bor, Fl. Assam *5:* 29. 1940; Hooker, Fl. British India *7:* 388. 1896.

Local name: Mokla, H.

Specimens examined: Karamtola, *Jha 6405.*

Bambusa vulgaris Schrad in Wendl. Collect. Pt. II. 26: t. 473. 1810.

Local name: Ban bans, H.

Specimens examined: Karanpurato, *Jha 6458.*

Bambusa vulgaris var. **striata** (Lindl.) Gamble in Ann. Roy. Bot. Gard. Calc. *7:* 44. 1896.

Specimens examined: St. Joseph School, Bhagalpur, *Jha 7502*; Tilkamanjhi, *Jha 7503.*

Dendrocalamus giganteus Munro in Trans. Linn. Soc. *26:* 150. 1868.

Local name: Uttari bans, H.

Specimens examined: Karamtola, *Jha 6632.*

Sorghum bicolor (L.) Moench, Meth. Pl. 207. 1794; Bor, Gr. Burma, Ceylon, Ind. & Pak. 227. 1960.

Specimens examined: Asanbani, *Das 3978.*

Sorghum miliiforme (Hack.) Snowden in Kew Bull. 1935: 237. 1935. var. **miliiforme**; Bor, Gr. Burma, Ceylon, Ind. & Pak. 239. 1960.

Local name: Bajri, Bajra, H.

Specimens examined: Mirzachowki, *Jha 6769.*

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38. SOME INTERESTING PLANT RECORDS FROM GARHWAL HIMALAYA

(With a plate)

Garhwal Himalaya is well known for its unique assemblage of vegetational wealth. The area has been extensively explored by several plant collectors, some of the important being, Hooker (1872-97); Duthie (1906); Rau (1961, 1975); Semwal and Gaur (1981); Kala and Gaur (1982); Naithani (1985); Gaur (1987); Deva and Naithani (1986) etc. During the recent plant explorations in the remote localities of Garhwal Himalaya we came across some interesting plant specimens which after identification turned out to be either additions to the flora of Garhwal or are collected after a long interval. *Corydalis elegans* Wall. ex Hook. f. et Thoms., *Saussurea candolleana* Wall. ex Hook. f., *Thalictrum punduanum* Wall. var. *glaucum* Hook. f. et Thoms., *Tussilago farfara* L. are additions to the flora of Garhwal and Thlaspi *andersonii* (Hook.f. et Thoms.) O.E. Schulz., *Pholidota imbricata* Lindl. and *Potamogeton octandrus* Poir. are collected after a long interval from Garhwal Himalaya. This communication includes the distribution of taxa in Garhwal, their localities, approximate elevation, collector's herbarium number as well as line diagrams.

Voucher specimens after following the usual herbarium methods, are deposited and maintained at the Herbarium, Department of Botany, HNB Garhwal University (GUH), Srinagar (Garhwal).

RANUNCULACEAE

Thalictrum punduanum Wall. var. **glaucum** Hook.f. et Thoms. in Hook. f. FBI. 1:13. 1872; Duthie, Cat. Kum. Pl. 2. 1906.

Distribution: Paldingdhaar (Chamoli); 2,000 m a.s.l. Coll. No. GUH-19, 841;Fig. E.

This plant was collected by Duthie from Pithoragarh (DD, dated — 15.8.1892) and by Janeson from Kumaon. Duthie (1906) also reported it from Naini Tal. Since these collections, the plant has not been collected from Kumaon and Garhwal Himalaya.

FUMARIACEAE

Corydalis elegans Wall. ex Hook. f. et Thoms. in Fl. Ind. 265. 1855; Hook.f. FBI. 1:124. 1872; Duthie, Cat. Kum. Pl. 10. 1906; Rau, High Alt. Fl. Pl. W. Himal. 66. 1975.

A. *Corydalis elegans* Wall. ex Hook. f. et Thoms.; B. *Pholidota imbricata* Lindl.; C. *Potamogeton octandrus* Poir.; D. *Saussurea candolleana* Wall. ex Hook. f. non Clarke; E. *Thalictrum punduanum* Wall. ex Hook. f. et Thoms. ; F. *Thlaspi andersonii* (Hook. f. et Thoms.) O.E. Schulz; G. *Tussilago farfara* Linn.

Distribution: Shilla Samudra (Chamoli); 5,000 m a.s.l. Coll. No. GUH- 19,721; Fig. A.

Hooker (1872), Duthie (1906) and Rau (1975) reported this plant from Kumaon Himalaya. However, there are no records of its collection from Garhwal Himalaya until the present collection.

BRASSICACEAE

Thlaspi andersonii (Hook. f. et Thoms.) O.E. Schulz in Anz. Akad. Wien. Math-Nat. 63:98 in Obs. 1926; *Iberidella andersonii* Hook. f. et Thoms. in Journ. Linn. Soc. 5: 177. 1861; Hook.f. FBI. 1: 163. 1872; Naithani, Fl. Ch. 1: 69. 1985.

Distribution: Jonk Tal (Chamoli); 3,400 m a.s.l. Coll. No. GUH-12, 862; Fig. F.

Hooker (1872) reported the occurrence of this plant in alpine zones of Kumaon and Garhwal Himalaya. Naithani (1985) reported it from North Garhwal on the basis of Duthie's literature. This is a rare plant, collected after a long interval.

ASTERACEAE

Saussurea candolleana Wall. ex Hook. f. in Hook. f. FBI. 3: 327. 1881; Rau, High Alt. Fl. Pl. W. Himal. 135. 1975.

Distribution: Dalisera (Chamoli); 3,700 a.s.l. Coll. No. : GUH-19, 453; Fig. D.

This plant was collected by Rao from Kumaon (BSD- 4,581, dated 1951). Hooker (1881) reported its occurrence in temperate Himalaya from Kashmir to Sikkim. However, it has not been collected earlier from Garhwal Himalaya.

Tussilago farfara Linn. Sp. Pl. 865. 1753; Hook. f. FBI. 3: 330. 1881; Duthie, Cat. Kum. Pl. 95. 1906.

Distribution: Karchh Forest (Chamoli); 2,300 m a.s.l. Coll. No. GUH - 14,616; Fig. G.

This plant has been collected from Kashmir and Himachal Pradesh. Duthie (1906) collected this plant from Kumaon. However, this plant has not been collected earlier from Garhwal Himalaya until the present collection.

ORCHIDACEA

Pholidota imbricata Lindl. in Hook. Ex. Fl. t. 138. 1825; Hook.f. FBI. 5:845. 1890; Duthie, Cat. Kum. Pl. 176. 1906; Babu, Herb. Fl. Dehra Dun. 495. 1977; Deva and Naithani, Orch. Fl. NW. Himal. 343. 1986.

Distribution: Karan Prayag (Chamoli); 780 m a.s.l. Coll. No.: GUH- 19, 747; Fig. B.

Babu (1977) and Deva and Naithani (1986) reported it from Dehradun area on the basis of Machinon's (s.n. CAL) and Duthie's specimen (DD-24192) respectively, which are about hundred years old. Since these collections plant has not been recorded from Garhwal.

POTAMOGETONACEAE

Potamogeton octandrus Poir. in Lamk. Ency. Suppl. 4: 517. 1816; Dandy, Journ. Linn. Soc. Bot. 50: 517. 1937; Babu, Herb. Fl. D. Dun. 544.1977; *P. javanicus* Hassk. Act. Soc. Ind.-Needrl. 1:26. 1856; Hook.f. FBI. 6: 566. 1890.

Distribution: Benital (Chamoli); 2,131 m a.s.l. Coll. No. GUH - 13,500; Fig. C.

Collett (1902) reported this plant from Shimla (Himachal Pradesh) and Babu (1977) reported this plant from Asan River, Dehradun on the basis of Machinon's specimen (DD, dated 15-3-1898). Since then plant has not been recorded from Garhwal and Kumaon.

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39. ADDITIONS TO THE FLORA OF MADHYA PRADESH

The present paper deals with three new records of Angiosperm taxa from Morena district of Madhya Pradesh. During the course of floristic survey, we have collected and identified 3 taxa as *Hibiscus caesius* Garcke (Malvaceae), *Sphenoclea zeylanica* Gaertn. (Sphenocleaceae) and *Ipomoea coptica* (L.) Roth ex Roem. & Schult (Convolvulaceae). The scrutiny of literature revealed that these taxa have not so far been reported from Madhya Pradesh.

Hibiscus Linn.

Hibiscus caesius Garcke, in Oester, Bot. Zeit. 7: 850. 1849, et in Peters, Reise Mossamb. 125; Cooke, Fl. Pres. Bomb. 1:16, 1958 (Pedr. ed.); Rakshit and Kundu, Bull. Bot. Surv. India 12: 173, 1970. *H. gibsoni* Stocks ex Harv. and Sond., Fl. Cap. 2: 587. 1861-62; Masters in Hook.f. Fl. Brit. India 1: 339, 1874. Duthie, Fl. Upp. Gang. Plain 1: 86, 1903. (MALVACEAE)

An erect, branched, whitish hairy or prickly perennial under shrub up to 1-2.5 m tall. Stem and branches bristly or with minute prickles. Leaves 3-5 partite; lobes oblong-lanceolate, sharply serrate, glabrous or hairy; petiole as long as blade. Involucral bracts usually 10, free, linear, prickly covering over the calyx. Peduncles axillary, solitary, longer than leaves. Flowers yellow with purple centre. Capsule ovoid painted, valves setose.

Ecological notes: Perennial, rarely found under bushes.

Fl. & Fr.: September-December.

11 species of *Hibiscus* L. occur in Madhya Pradesh. This species differs from the others in having involucral bracts free, prickly and longer than calyx.

Specimens examined: Morena district: Karahal (RLSS. 658).

Sphenoclea Gaertn.

Sphenoclea zeylanica Gaertn., Fruct. 1: 113, t. 24, f. 5. 1788; Graham, Cat. 248. 1839; Khan and Huq, in Khan Fl. Bangladesh 5:2. 1977; Clarke in Hook. f., Fl. Brit. India 3 : 438. 1881; Cooke, Fl. Pres. Bomb. 2: 134. 1904; Duthie, Fl. Upp. Gang. Pl. 1: 484. 1903; Babu, Herb. Fl. Deh. 295. 1977. *S. pongaticum* A.D.C. Prodr. 7: 548. 1838. (SPHENOCLEACEAE)

An erect, glabrous, simple or branched flashy annual herb up to 70 cm tall. Leaves elliptic-lanceolate, linear-oblong, tapering at both ends, acute or sub-acute, entire. Flowers small, greenish white, sessile, in dense terminal, peduncled spikes. Bracts and bracteoles sub spathulate, obtuse, accrescent, connivent in fruiting. Capsule semi-inferior, wedge shaped, truncate, crowned with persistent calyx lobes.

Ecological notes: Fleshy annual, rarely found in marshy places.

Fl. & Fr. : September-November.

A new record for the family. This species is generally found in coastal regions in partially saline soil and its occurrence away from Seashore is of significance. The plant is a serious cattle poison.

Specimens examined: Morena district: Sheopurkalan (RLSS. 272).

Ipomoea Linn.

Ipomoea coptica (L.) Roth ex Roem. & Schult, Syst. 4: 208. 1819; Maheshwari, Fl. Del. 237. 1963; Majumdar in Bull. Bot. Surv. India 18: 52. 1976; Bhandari, Fl. Ind. Des. 252. f. 86. 1978;

Shah, Fl. Guj. 1: 468. 1978; Johri, in J. Econ. Tax. Bot. 5: 1122. 1984. *Convolvulus copticus* Linn. Mart. 2, Appen. 599. 1771.

Ipomoea dissecta Willd., Phytogr. 5: t. 2, f. 3. 1794; Clarke in Hook. f. Fl. Brit. India 4: 200. 1883; Cooke, Fl. Pres. Bomb. 2: 249. 1905 (Repr. ed. 2: 318. 1958); Duthie, Fl. Upp. Gang. Pl. 2: 115. 1911 (Repr. ed. 1: 556. 1960). (CONVOLVULACEAE)

A glabrous, prostrate or twining annual herb, upto 90 cm. long. Leaves digitately to pedately 3-7 lobed; lobes deeply serrate or dentate, or sometimes twice pinnatifid, ovate, elliptic, lanceolate or oblanceolate in outline. Petiole mostly shorter than the blade. Inflorescence axillary. Flowers white or Pale cream, 8013 mm long. Capsule globose, 3 celled; seeds 2, densely greyish-tomentose.

Ecological notes: Prostrate, annual found in sandy soil along rice fields.

Fl. & Fr.: August-December.

11 species of *Ipomoea* L. occur in Madhya Pradesh. This species differs from the others in having: Leaves digitate; lobes - 7, with deeply serrate or dentate margin.

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40. SOME NEW RECORDS OF PLANTS FOR ORISSA

During ethnobotanical survey of Orissa, we collected 5 plant species, which have been identified as *Cassia alta* L., *Digera muricata* (Linn.) Mart., *Echinops echinatus* Linn., *Heliotropium supinum* L. and *Ranunculus sceleratus* Linn. The literature on floristics of Orissa shows that occurence of these taxa from the state has not been reported earlier. The voucher specimens are preserved in the Herbarium of Regional Research Institute of Unani Medicine, Bhadrak.

AMARANTHACEAE

Digera muricata (Linn.) Mart., Beitr. Amar. 77. 1825; Henry *et al.*, Fl. Tamil Nadu 2: 192. 1987. *D. arvensis* Forssk. Fl. Aeg.-Arab. 65. 1775; Duthie, Fl. Upper gang. plain 3: 8. 1973 (repr. ed.); Gamble, Fl. Pres. Madras 2: 1168. 1984 (repr. ed.). *D. alternifolia* Aschres. in Haines, Bot. Bihar Orissa 5-6: 760. 1978 (repr. ed.).

A slender annual herb upto 60 cm high. Leaves alternate, entire, glabrous, ovate to elliptic with rounded or cuneate base. Inflorescence axillary spikes with small pink flowers. Fruit a subglobose crustaceous nut.

Occasional in harvested fields.

Fl. & fr.: July - December.

Nuagarh (Cuttack), 3.11.1989, *Girach & Aminuddin 3295.*

BORAGINACEAE

Heliotropium supinum L., Sp. Pl. 1753; Clarke in Hook. f., Fl. Brit. India 4: 149. 1883; Duthie, Fl. Upper gang. plain 2: 91. 1973 (repr. ed.); Gamble, Fl. Pres. Madras 2: 896. 1984 (repr. ed.); Henry *et al.*, Fl. Tamil Nadu 2: 100. 1987.

Prostrate much branched, softly white villous herbs. Leaves elliptic ovate, obtuse upto 2.5 cm long with crenate margin. Inflorescence short, wooly one sided spike. Flowers small white. Nutlets 1-4 margined, enclosed in the calyx.

Occasional weed in harvested fields.

Motunga (Dhenkanal), 11-3-1989, *Girach & Aminuddin 3010.*

CAESALPINIACEAE

Casssia alata L., Sp. Pl. 378. 1753; Baker in Hook. f. Fl. Brit. India 2: 264. 1878; Nair &

Henry, Fl. Tamil Nadu 1: 129. 1983; Gamble, Fl. Pres. Madras 1: 404. 1984 (repr. ed.).

Large shrubs with thick branches and persistant deltoid stipules. Leaves 30-70 cm long, leaflets oblong obtuse 5-15 cm long, glabrous, oblique at base. Inflorescence raceme on long peduncles, flowers yellow. Pods membranous 8-12 cm long, brownish black. Seeds many.

Occasional on waste grounds.

Fl. & fr. : November - February.

Jaleswar (Balassore), 24-1-1989, *Girach & Aminuddin 2917.*

COMPOSITAE

Echinops echinatus Roxb., Fl. Ind. 3: 447. 1832; Hook. f. Fl. Brit. India 3: 358. 1881; Haines, Bot. Bihar Orissa 3-4: 490. 1978 (repr. ed.); Gamble, Fl. Pres. Madras 2: 724. 1984 (repr. ed.); Henry *et al.*,Fl. Tamil Nadu 2: 37. 1987.

Thistle like herbs with white tomentum. Stems dichotomously branched, rigid upto 70 cm high. Leaves sessile, alternate, pinnatifid and spinous 10-15 cm long. Heads one flowered, arranged in a compact globose inflorescence 3-5 cm in diameter with involucre of spinose bracts. Flowers small white. Cypsele silky villous. Pappus short yellowish.

Occasionally on road sides.

Fl. & fr.: March - June.

Paikmal (Sambalpur), 25-3-1986, *Girach & Aminuddin 2010.*

RANUNCULACEAE

Ranunculus sceleratus Linn., Sp. Pl. 551. 1753; Fl. Brit. India 1: 19. 1872; Haines, Bot. Bihar Orissa 1-2: 6. 1978 (repr. ed.).

An erect, glabrous annual 40-45 cm high, much branched. Leaves 3 partite, segments cuneate and lobed. Flowers small yellow. Achenes in oblong heads, turgid.

Occasionally on wet grounds.

Fl. & fr.: November – March.

Chalanti (Balasore), 20-1-1989, *Girach & Aminuddin 2874.*

ACKNOWLEDGEMENTS

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December 1, 1992 R.D. GIRACH
AMINUDDIN

Survey of Medicinal Plants Unit,
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Bhadrak – 756 100 (Orissa).

DONATION

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