Acknowledgements

We thank Nils van Duivendijk for helping with ageing and morphs of birds in some photographs. We also thank Andre van Loon for helping with references from *Dutch Birding* and Ashvin Trivedi, and V. Joshi for sharing their sightings.

References

Dickinson, E. C., & Remsen, J. V. J., (eds.) 2013. *The Howard and Moore complete checklist of the birds of the world: 1. Non-passerines*. 4th ed. Eastbourne, U.K.: Aves Press. Vol. 1 of 2 vols.: Pp. i–l, 1–461.

Dharmakumarsinhji, R. S., Undated [=1955]. *Birds of Saurashtra, India: With additional notes on the birds of Kutch and Gujerat.* 1st ed. Bhavnagar, Saurashtra: Published by the author. Pp. i–liii, 1–561.

Forsman, D., 2006. *The raptors of Europe and the Middle East.* Christopher Helm. London. Pp. 1–xviii, 1–589.

Gill, F., & Donsker, D., (eds.) 2013. IOC World Bird List (v 3.3). Available at http://www.worldbirdnames.org.

Grimmett, R., Inskipp, C., & Inskipp, T., 1998. *Birds of the Indian Subcontinent.* 1st ed. London: Christopher Helm, A & C Black. Pp. 1–888.

Grimmett, R., Inskipp, C., & Inskipp, T., 2011. *Birds of the Indian Subcontinent.* 2nd ed. London: Oxford University Press & Christopher Helm. Pp. 1–528.

Kazmierczak, K., 2000. *A field guide to the birds of India, Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh and the Maldives.* 1st ed. London: Pica Press / Christopher Helm. Pp. 1–352.

Lindhom, A., & Forsten, A., 2013. "Common" Buzzards of South China and South-East Asia. *Caluta* 4 (August): 1–11.

Naoroji, R., 2006. *Birds of prey of the Indian Subcontinent.* 1st ed. New Delhi: Om Books International. Pp. 1–692.

Parmar, V., 2011. Website: http://www.indianaturewatch.net/displayimage.php?id=286708. [Accessed on 5 May 2013].

Rasmussen, P. C., & Anderton, J. C., 2012. *Birds of South Asia: the Ripley guide.* 2nd ed. Washington, D.C. and Barcelona: Smithsonian Institution and Lynx Edicions. 2 vols. Pp. 1–378; 1–683.

Roberts, T. J., 1991. *The Birds of Pakistan: Regional Studies and non-passeriformes.* 1st ed. Karachi: Oxford University Press. Vol. 1 of 2 vols. Pp. i–xli, 1–598.

Shirihai, H., & Forsman, D., 1991. Steppe Buzzard morphs at migration and their separation from Long-legged Buzzard. *Dutch Birding* 13 (December): 197–209.

Tiwari, J. K., Francis, C., Ganesh, J., & Venkatraman, S., 2008. Common Buzzard *Buteo buteo vulpinus* in Kachchh, Gujarat, India. *Indian Birds* 4 (2): 72.

van Duivendijk, N., 2011a. *Advanced bird ID handbook: The Western Palearctic*. New Holland. London.

van Duivendijk, N., 2011b. Steppe Buzzard in the Netherlands: revision status and identification. *Dutch Birding*. 33 (5): 283–293 [In Dutch with English summary].

Varu, M., 2011. Common Buzzard in Jamnagar. *Vihang* 5 (1): 22. [In Gujarati].

Diet of the Spotted Owlet *Athene brama* in an urban landscape

Ashish N. Nerlekar, Gaurang G. Gowande & Pratik S. Joshi

Nerlekar, A. N., Gowande, G. G., & Joshi, P. S., 2014. Diet of the Spotted Owlet *Athene brama* in an urban landscape. *Indian BIRDS* 9 (2): 45–48.
Ashish N. Nerlekar, 6, Shree Niwas Gaurav Apartment, Mayur Colony, Prabha housing society, Kothrud, Pune 411029, Maharashtra, India.
Corresponding author. Email: *ashishadmirerofficus@gmail.com*
Gaurant G. Gowande, 1st floor, 13, Govardhan Housing Society, Padmavati, Sahakar Nagar, No. 1, Pune 411009, Maharashtra, India.
Pratik S. Joshi, 1487, Shukrawar peth, Bajirao Road, Near Janata Sahakari Bank, Pune 411002, Maharashtra, India.
Manuscript received on 29 April 2013.

Abstract: We aimed to study the food habits of the Spotted Owlet *Athene brama* by combining the pellet analysis as well as direct/visual observation methods. Both methods were used simultaneously for seven months. Direct observations were carried out by visually monitoring the owlets for 214 days, over 642 hrs. All events of feeding were recorded, and prey identified using relevant field guides. 70 pellets were collected from the roosting site of the same owlet pair, treated, and further analysed for remains of prey items. A total of 11 prey orders were recorded by both the methods. Out of these, 3 orders were detected only by pellet analysis, 5 orders were detected only by direct observations, and 3 orders were detected by both the methods. Common Indian toads, cicadas, and wasps were some new prey taxa/items detected by us during this study. As each of the followed method has its own advantages as well as limitations, we combined both the methods to obtain a more reliable dietary of this species.

Introduction

The Spotted Owlet *Athene brama* is a common nocturnal raptor, widely distributed throughout the Indian Subcontinent and abundant, especially, around human habitation (Ali & Ripley 1983; Ali 2002). Owls are known to play an important role in the bio-control of pests (Santhanakrishnan *et al.* 2011). Considerable work has been done regarding the dietary analysis of the Spotted Owlet from various geographical areas including India (Jain & Advani 1983; Kumar 1985; Jadhav & Parasharya 2003; Pande *et al.* 2004; Santhanakrishnan *et al.* 2011; Zade *et al.* 2011), and neighbouring countries like Pakistan (Beg *et al.* 1990; Shah *et al.* 2004). All the aforementioned studies have used only one method in the analysis of the owlet's dietary: study of regurgitated pellets. Our aim was to determine its dietary using both methods, pellet analysis and direct observation, simultaneously.

Study area & methods

The present study was carried out in the campus of Fergusson College, Pune (18°31'N, 73°50'E; 570 m asl). A combination of

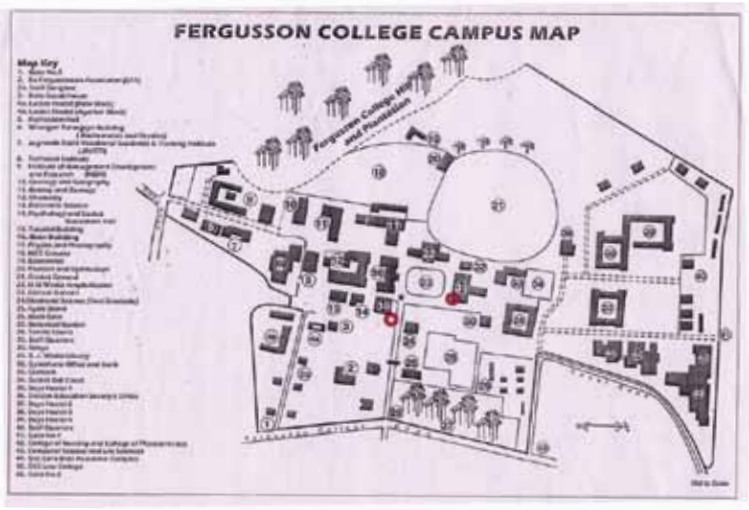


Fig. 1. Map of study area. Monitored roosting sites are marked with red circles.

methods was used to understand the dietary composition of the study species—we combined the popularly used pellet analyses technique with direct observations to obtain a reliable qualitative dietary composition of the Spotted Owlet. The study was carried out for a total of 214 days from 01 April 2012 to 31 October 2012. The roosting/nesting sites of the owlets monitored are given in Fig. 1.

Direct observation

We monitored two pairs of Spotted Owlet adults and their juveniles (from approximately 20 days of hatching out) for seven months to document opportunistic dietary records. A pilot study for obtaining direct observations revealed that the maximum frequency of feeding occurs between 1830 hrs and 2130 hrs. Hence, the observations were made from 1830 hrs to 2130 hrs (total effort=642 hrs) using a pair of binoculars and torches. Juveniles were tracked following their distinct call. All events of foraging by adults or by the adult/s to the juvenile/s were visually observed and photographed (Pic XX1). Prey was identified based on morphological characters which were evident in the field and from the photographs we clicked, after consulting Daniel (2002), and Daniels (2011) for reptiles and amphibians, and Distant (1906), and Mani (2004) for insects; these were also validated by consulting experts in the field.

Pellet analysis

Additionally, 70 freshly regurgitated pellets were also collected from below two roosting/nesting sites of the same owlet families, packed in polythene bags, and labelled for further identification. The pellets were treated in a hot air oven at 70ºC for 24 hrs for eliminating any associated invertebrates and were further treated with 8% NaOH (Sodium Hydroxide). The prey items were identified following Talmale & Pradhan (2009) for rodents, Asokan *et al.* (2009) for insect orders, and for other vertebrate

Table 1: List of prey items identified in Spotted Owlet pellets during the study period

No.	Date 2012	Time [hrs]	Prey item					Total no. of prey items detected		Eaten by Juveniles / Adults
			Order	Family	Genus	Species	Common name	Direct obs.	Pellet analysis	
1	19 April 14 May	2115 2025	Anura	Bufonidae	*Bufo* (=*Duttaphrynus*)	*melanostictus**	Common Indian Toad	02	–	Juvenile
2	17 April–12 May	1900–2030	Homoptera	Cicadidae*	Unidentified	Unidentified	Cicada	147	–	Juvenile
3	01 September	1920	Hymenoptera	Vespidae*	*Vespa*	Unidentified	Wasp	03	–	Adult
4	09 May– 19 July	–	Hymenoptera	Formicidae	*Campanotus*	Unidentified	Carpenter ant	–	15	Unknown
5	17 April– 30 October	–	Coleoptera	Scarabaeidae	Unidentified	Unidentified	Beetle	16	55	Adult
6	17 May	1940	Blattodea	Blattidae	*Periplaneta*	Unidentified	Cockroach	02	–	Juvenile
7	13 May– 12 June	1900–2100	Squamata	Geckkonidae	*Hemidactylus*	Unidentified	House gecko	07	06	Adult & Juveniles
8	15 May 05 April	1942	Squamata	Agamidae	*Calotes*	*versicolor*	Garden Lizard	02		Adult
9	22 April	1935	Scolopendro-morpha	Unidentified	Unidentified	Unidentified	Centipede	01		Adult & Juveniles
10	05 May 18 May 24 May 17 July 02 October	–	Orthoptera	Unidentified	Unidentified	Unidentified	Grasshopper	–	05	Unknown
11	01 May	1915	Isoptera	Unidentified	Unidentified	Unidentified	Termites	07		Juveniles
12	20 June 23 July	–			Threads			–	✓	Unknown
13	24 April 27 April 25 May	–			Plant mater (seeds/fibres)			–	✓	Unknown
14	20–25 May	–	Rodentia	Muridae	*Mus*	sp.	House mouse	–	11	Unknown
15	08 June– 11 August	–	Soricomorpha	Soricidae	*Suncus*	*murinus*	Asian house shrew	–	07	Unknown

* Prey taxa/items reported for the first time by this study.

Note: For number of prey items calculated in pellet analysis, one item corresponds to remains of that prey item found in one pellet. Whereas, for direct observation, one item corresponds to one entire intact prey species that is photographed. Thus, one pellet may contain remains of more than one individual of that prey species though it is counted as one.

prey, museum specimens (Zoology Department, Fergusson College) from the same area were referred. Experts of respective taxa were also consulted for identification.

Results

We recorded a total of 286 prey items belonging to 11 Orders using both the methods (Table 1). Out of these, 3 Orders were detected only through pellet analysis, 5 Orders only by direct observations, and 3 were detected by both the methods.

Common Indian Toad *Duttaphrynus melanostictus* in the diet of spotted owlet

Kumar (1985) reported the occurrence of anurans (=frogs) for the first time in the diet of Spotted Owlet. To date, only Jadhav & Parasharya (2003) have recorded presence of the toad *Bufo stomaticus (=D. stomaticus)* in the diet of this owlet.

We observed the following series of events on the aforementioned date:

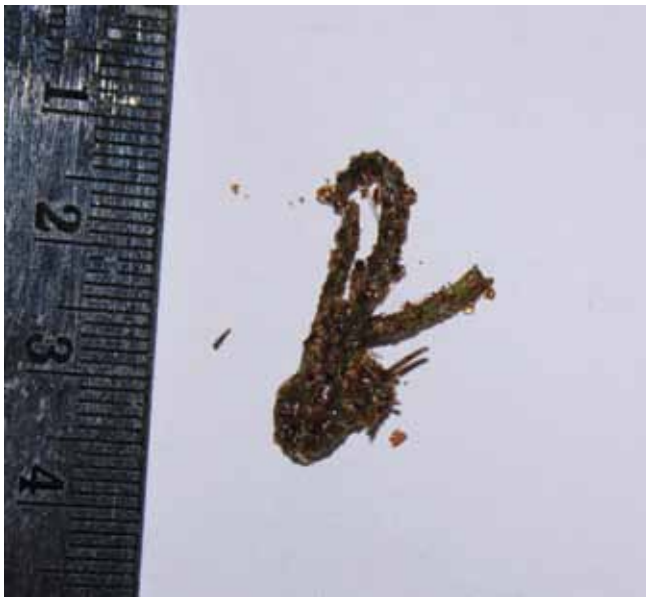
At 2115 hrs an adult owlet successfully attacked a toad that was foraging for insects near a lamp-post. At 2117 hrs, it fed the injured toad to one of the juveniles that was perched on a branch. The juvenile immediately grasped the toad in its claws and started to feed on its head. By 2125 hrs the toad was completely ingested [**58**].

On 14 May 2012 we observed a similar series of events in the same area and by the same owlet pair. Based on our observations, it appears that Spotted Owlet can feed on *Bufo (=Duttaphrynus) sp*., and as suggested by Jadhav & Parasharya (2003), the poison glands on the toad's skin do not affect the owlet.

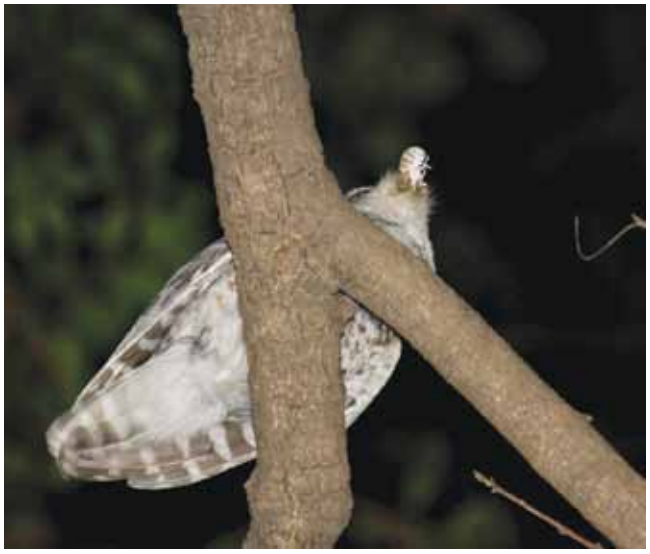
Rubber band in the diet of Spotted Owlet

On analyzing the pellet collected on 17 July 2012, we found a greenish elastic material entangled in the crushed matter of other prey. On further dissection and clearing, it was identified as a 2 mm thick rubber band. The band was intact to a greater extent and had minor scraping marks [**59**]. Such artificial materials in an owlet's pellet indicate two possibilities: Direct ingestion of the material mistaking it for its natural prey, or indirect ingestion by feeding on rodents or other prey that had ingested the artificial material.

58. Spotted Owlet feeding on Common Indian Toad



59. Rubber band in owlet pellet



60. Spotted owlet feeding on Cicadidae nymph

Cicadidae and *Vespa* species in the diet of the Spotted Owlet

We also recorded the occurrence of family Cicadidae (order Homoptera) in the diet of the Spotted Owlet juveniles [**60**]. Specimens from the same area were identified based on morphological characters following the keys provided by Distant (1906). It was observed that for their juveniles, the adult owlets preferred to hunt freshly moulted nymphs of Cicadidae that were present on the vertical surfaces of rocks, old walls, and tree trunks, probably due to the soft nature of the nymphs. Similarly, *Vespa* species (order Hymenoptera) in the diet of the adult owlets was also observed by us.

Discussion

Both the methods followed in this study have their own advantages and disadvantages. Pellet analysis is considered to be a reliable and non-invasive method for dietary analysis of insectivorous birds (Ralph *et al.* 1985). Prey items that have soft body parts (like insect nymphs) are easily digested and consequently no remains are left in pellets. Hence pellet analysis cannot detect such prey (Lewis *et al.* 2004). Also, as the matter in pellets is crushed to a great degree (Zade *et al.* 2011), pellet analysis can detect insect prey items mostly upto the level of Order. Whereas, direct observation method is highly labour intensive (Lewis *et al.* 2004) but can sometimes facilitate identification of prey at Genus level. Hence recent studies (Simmons *et al.* 1991; Redpath *et al.* 2001; Jathar & Rahmani 2004; Lewis *et al.* 2004; Margalida *et al.* 2005) have preferred a multi-method approach for dietary analysis of raptors. Due to the nocturnal habit of the bird and logistical constraints, the sampling for direct observation was restricted to three hours daily, which might have caused an observational bias in the present study.

The Spotted Owlet has adapted well in the urban landscape and this is indicated by it's habit of using electric wires (Ali & Santhanakrishnan 2013), or lamp-posts, as perches for foraging, and also roosting on man-made structures like wooden ledges. Majority of the Spotted Owlet's prey can be termed as household pests, as plant bugs, beetle larvae, rodents, termites, and ants cause considerable damage to trees, garden plants, or furniture (Pawar & Desai 2011). Use of artificial insecticides and pesticides against such pests has known to cause significant side-effects on human health and has also contributed to the deterioration of the environment (Casida & Quistad 1998). Entomophagous birds like the study species are known to play the role of effective bio-control agents against pests (Santhanakrishnan *et al.* 2011; Kler & Kumar 2013).

Also, among all the Indian owl species, the Spotted Owlet is reported to have the highest frequency of occurrence in illegal trade across the country (Ahmed 2010). Hence, in spite of it being listed under 'Least Concern' (IUCN 2012), *in situ* conservation of this species is essential due to its aforementioned role in the urban ecosystem.

Acknowledgements

The present study was partially funded by CPE Grants under UGC, awarded to Fergusson College, Pune. We are grateful to Prof. S. B. Nalavade for his guidance. We also thank Prerna Agarwal and Trishant Simlai for their valuable help in editing the manuscript. Credits are due to Dr. S. S. Talmale for helping us out with identification of rodents. We would also like to thank Mr. Shyam, Mr. Ismail and Mr. Shankar for ensuring our security during the study period. Lastly, this work would not have been possible without the encouragement of Anand Mohan, Himanshu Chhattani, Anand Nawathe, Amit Watve, and Anirudh Chaoji.

References

Ahmed, A., 2010. *Imperilled custodians of the night: A study on illegal trade, trapping and utilization of owls in India*. TRAFFIC India/WWF- India. New Delhi, India. 80 pp.

Ali, A. M. S., & Santhanakrishnan, R., 2013. On usage of perches by the Spotted Owlet. *Taprobanica* 5 (2): 154–155.

Ali, S., 2002. *The book of Indian birds.* 13th (Revised) ed. Mumbai: Bombay Natural History Society & Oxford University Press. Pp. i–lvii, 1–326+7.

Ali, S., & Ripley, S. D., 1983. *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka. Forgmouths to pittas.* 2nd (Hardback) ed. Delhi: (Sponsored by Bombay Natural History Society.) Oxford University Press. Vol. 4 of 10 vols. Pp. i–xvi, 1–267+5.

Asokan, S., Ali, A. M. S., & Manikannan, R., 2009. Diet of three insectivorous birds in Nagapattinam district, Tamil Nadu, India–a preliminary study. *Journal of Threatened Taxa* 1 (6): 327–330.

Beg, M. A., Maqbool, M., ul-Hassan, M. M-., 1990. Food habits of the Spotted Owlet *Athene brama. Pakistan Journal of Agriculture & Science* 27 (2): 127–131.

Casida, J. E., & Quistad, G. B. 1998. Golden age of insecticide research: Past, present, or future? *Annual Review of Entomology* 43: 1–16.

Daniel, J. C., 2002. *The book of Indian reptiles and amphibians*. Bombay Natural History Society and Oxford University Press, Bombay. Pp. 1–238.

Daniels, R. J. R., 2011. *Amphibians of peninsular India.* Indian Academy of Sciences and Universities Press (India) Private Limited. Pp. xii+ 268.

Distant, W. L., 1906. Rhynchota–Homoptera. In: Bingham, C. T., (Ed.) *The fauna of British India including Ceylon and Burma.* Vol. 3. Pp. 503.

IUCN., 2012. The IUCN Red List of Threatened Species. <*http://www.iucnredlist.org/details/summary/106002288/0*>

Jadhav, A., & Parasharya, B. M., 2003. Some observations on the nesting behaviour and food of the Spotted Owlet Athene brama. *Zoos' Print Journal* 18 (8): 1163–1165.

Jain, A. P., & Advani, R., 1984. Winter food of Spotted Owlet Athene brama indica. *Journal of the Bombay Natural History Society* 80 (2): 415–416.

Jathar, G. A., & Rahmani, A. R., 2004. Ecological studies of the Forest Spotted Owlet Athene (Heteroglaux) blewitti. Final Report. Bombay Natural History Society, Mumbai, India. 77 pp.

Kler, T. K., & Kumar, M., 2013. Breeding of Spotted Owlet *Athene brama* in nest boxes and conservation aspects. *Journal of the Bombay Natural History Society* 109 (1&2): 135–139 (2012).

Kumar, T. S., 1985. *The life history of the Spotted Owlet (Athene brama brama, Temminck) in Andhra Pradesh.* Hyderabad: Raptor Research Centre. Pp. 1–241.

Lewis, S. B., Fuller, M. R., & Titus, K., 2004. A comparison of three methods for assessing raptor diet during the breeding season. *Wildlife Society Bulletin* 32 (2): 373–385.

Mani, M. S., 2004. *Insects*. National Book Trust, India. Pp. x+162.

Margalida, A., Bertran, J., & Boudet, J., 2005. Assessing the diet of nestling Bearded Vultures: a comparison between direct observation methods. *Journal of Field Ornithology* 76 (1): 40–45.

Neelanarayanan, P., Nagarajan, R., & Kanakasabai, R., 1998. Studying diet of Barn Owl *Tyto alba stertens* by pellet analysis. In: *Birds in Agricultural Ecosystem*. Dhindsa, M. S., Rao, P. S., & Parasharya, B. M., (eds.). Hyderabad: Society for Applied Ornithology: Pp. 125–131.

Pande, S., Pawashe, A., Bastawade, D. B., & Kulkarni, P. P., 2004. Scorpions andmolluscs: Some new dietary records for Spotted Owlet Athene brama in India. *Newsletter for Ornithologists* 1 (5): 68–70.

Pawar, K. R., & Desai, A. E., 2011. *A text book of general zoology and biological techniques-i.* Nirali Prakashan. Pune. Pp. 1–262.

Ralph, C. P., Nagata, S. E., & Ralph, C. J., 1985. Analysis of droppings to describe diets of small birds. *Journal of Field Ornithology* 56 (2): 165–174.

Redpath, S. M., Clarke, R., Madders, M., & Thirgood, S. J., 2001. Assessing raptor diet: comparing pellets, prey remains and observational data at Hen Harrier nests. *The Condor* 103 (1): 184–188.

Santhanakrishnan, R., Ali, A. H. M. S., & Anbarasan, U., 2011. Food habits and prey spectrum of Spotted Owlet *Athene brama* in Madurai District, Tamil Nadu, Southern India. *Chinese Birds* 2 (4): 193–199.

Shah, Z. A., M. A. Beg and A. A. Khan (2004). Prey preferences of the Spotted Little Owl (*Athene brama*) in the croplands near Faisalabad-Pakistan. *International Journal of Agriculture and Biology* 6(2): 278–280.

Simmons, R. E., Avery, D. M., & Avery, G., 1991. Biases in diets determined from pellets and remains: correction factors for a mammal and bird-eating raptor. *Journal of Raptor Research* 25 (3): 63–67.

Talmale, S. S., & Pradhan, M. S., 2009. Identification of some small mammal species through owl pellet analysis. *Records of the Zoological Survey of India, Occassional Paper No.* 294: 1–44.

Zade, V., Thakare, V., & Chirde, P., 2011. Prey preferences of Spotted Owlet *Athene brama* in G. V. I. S. H. Campus, Amravati, Maharashtra, India*. Middle-East Journal of Scientific Research* 10 (3): 410–413.