Bioprospecting Potential of Ethiopian *Naja species* Snake for Access and Benefit Sharing

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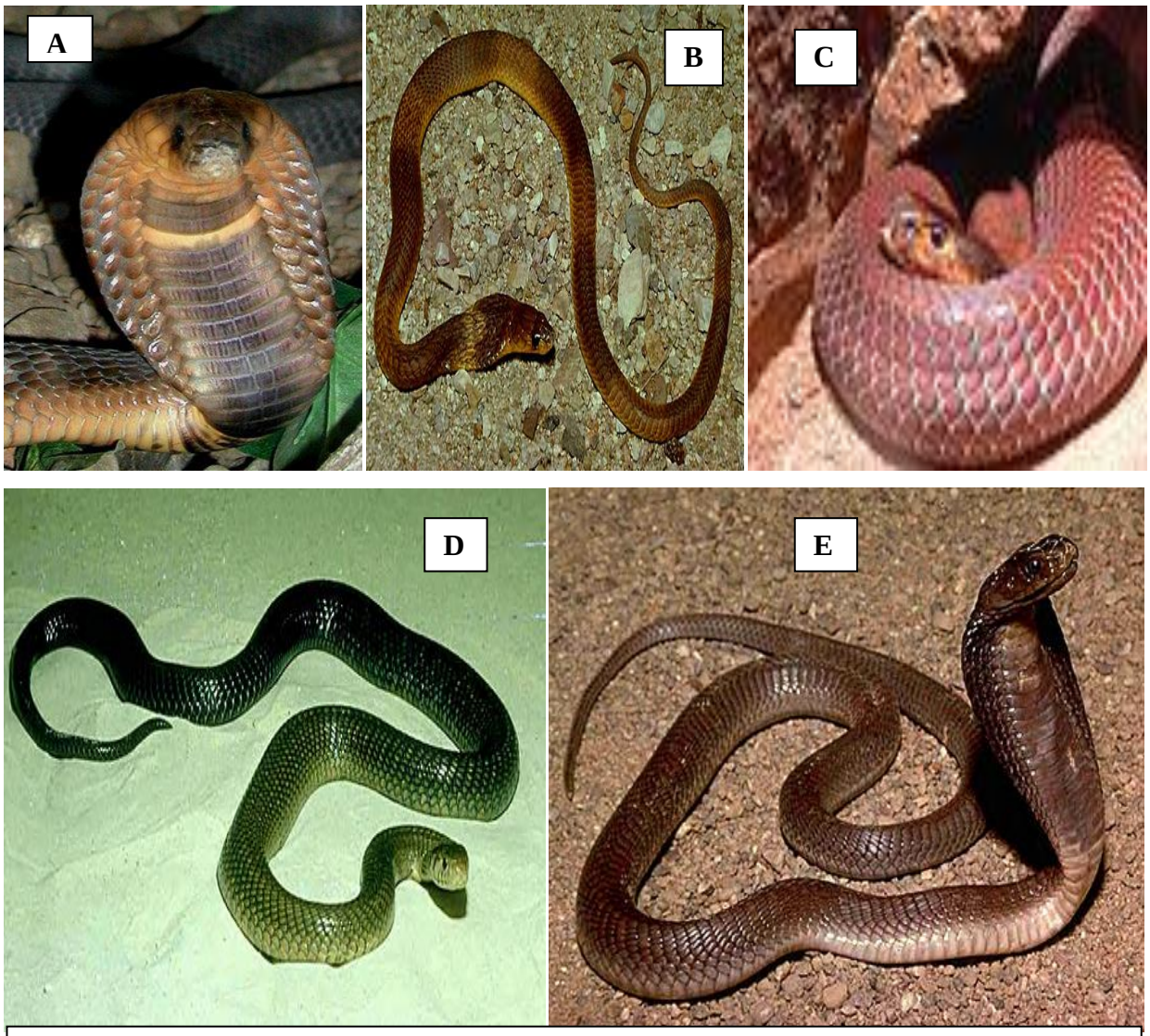

Figure: *Naja Haje* (A and B), *Naja pallida* (C), *Naja melanoleuca* (D), *Naja nigricollis* (E) (Picture taken from Wikipedia the Free Encyclopedia, 2019 and LHD, 2013).

1. Introduction

Ethiopia is one of the top biodiversity-rich countries in the world. The country is endowed with great diversity of plant, animal and microbial genetic resources (EBI, 2014). The variable agro-ecological conditions and availability of diverse floral resources makes the country as one of the very suitable place for the existence of large and unique biodiversity both in plants and animals. As a result, the country is well-known for its endemism and its being a centre of biodiversity for a number of plant and animal species (Nuru Adgaba, 2002).

Snakes are highly specialized, legless squamate reptiles and the most feared animal in the world absent only from some ocean islands, the Antarctica, and very high latitudes (Stephen *et al*., 2018). Snakes co-exist with humans in homes, gardens and outhouses but their presence usually goes unnoticed. Snakes are beneficial to humans by killing unwanted insects and rodents in food stores and crops. The venom is used for producing life-saving antivenin, biomedical research and for other medicinal products (Hezron and Alex, 2015). However, like other developing countries, technical expertise and monetary resources are the main challenges to use the potential resources of the country. Therefore, the only option for Ethiopia is to collaborate with the developed nations, domestic investors and other companies interested to participate on the potential genetic resources of the country to exploit them for mutual benefits wisely.

Ethiopia has issued a Proclamation on Access to Genetic Resources and Community Knowledge, and Community Rights (Proclamation No 482/2006 and Regulation 169/2009). The Proclamation includes ownership, user rights, conditions for access, benefit sharing, types of benefits, powers and responsibilities between users and providers are the main frameworks. This can be achieved in the Access and Benefit Sharing Directorate of Ethiopian Biodiversity Institute. Based on these frameworks, the country has been implementing an access and benefit sharing objective of CBD. Therefore, the objective of this information is to motivate and encourage any bioprospecting company or an interested individual to work on the collection of an animal genetic resource of *Naja species* snake venom from the wild for medicinal use, as flavoring, and preservative agents in food industries.

2. Description of *Naja spss.* Snake

Naja spp belong to the Reptilian Order Squamata, Suborder Serpentes and Family Elapidae. Naja is a genus of venomous elapid snakes known as cobras. Several other genera include species commonly called cobras, but members of the genus Naja are the most widespread and the most widely recognized as "true" cobras (Wikipedia, 2019). The Naja species of snake is found in Africa and Asia (LHD, 2013). Ethiopia has four Naja species of snakes (*Naja haje, Naja melanoleuca, Naja nigricollis* and *Naja pallid*) (Largen and Rasmussen, 1992; LHD, 2013) In addition, Wikipedia (2019) lists Ethiopia as the country having the geographical range of *Naja* species (*Naja ashei, Naja haje, Naja nigricollis, Naja pallid* and *Naja subfulva*).

3. Distribution of *Naja spp.* snake in Ethiopia

Naja haje is geographically distributed in Africa and southern Arabian Peninsula. It has big, thick-bodied cobra with broad head and fairly large eyes with a maximum adult body of 2.5 m; body usually yellow gray to brown or blue black, but extremely variable. It can produce large volume of venom with its relatively large fangs. It is found in various habitats: flat land, scrubby bushes, grass clumps, irrigated fields, rocky hillsides, old ruins; old termite mound or rodent burrow and near villages (LHD, 2013). According to Largen and Rasmussen (1992), *Naja haje* has been recorded at altitudes of 100-2000 m.a.s.l. in Ethiopia

Naja melanoleuca is geographically distributed in sub-Saharan Africa (Largen and Rasmussen, 1992). It is a very active nocturnal, terrestrial and semi-aquatic snake which climbs and swims well. It is known for its aggressive behavior, large size and potent venom (LHD, 2013). In Ethiopia *Naja melanoleuca* be restricted to the southwestern region of the country (Largen and Rasmussen, 1992). This species is able to deliver venom yields above 1 gram per milking (Mirtschin *et al*., 2006).

Naja nigricollis species of cobras are mainly terrestrial, but fairly good swimmers and climbers. They are widespread across many countries in central and southern Africa. They are found mainly in moist or Dry Savanna or Sahel, where they shelter in abandoned termite mounds, rodent burrows, or hollow trees (LHD, 2013). They are considered to be rare and these records of occurrence indicate that there is some degree of ecological isolation. *Naja nigricollis* tends to

favour rather moist environments and perhaps penetrates the more arid south eastern regions of the country by way of permanent water courses (Largen and Rasmussen, 1992).

Naja pallid has been reported from several countries in central and eastern Africa. It has both nocturnal and diurnal behavior. It is reportedly found under brush piles or other ground cover or in holes when not active. It is mainly terrestrial, though usually climbs into bushes or low trees. It is fast moving and alert. It rears up relatively high if disturbed and spreads a long narrow hood (LHD, 2013). *Naja pallid* is currently found distributed from Egypt southwards throughout Sudan, Ethiopia and Somalia to Kenya and northern Tanzania (Largen and Rasmussen, 1992).

4. Chemical composition of Snake venom

Snake venoms are natural biological resources, consisting of complex mixtures of enzymes, peptides and proteins of low molecular weight with specific chemical and biological activities (Sonia and Reema, 2013). They consist of proteins, enzymes, and substances with a cytotoxic effect, neurotoxins and coagulants (Pingale *et al*., 2014). Proteins and peptides account for 90 % of their dry weight (Bieber, 1979; Sonia and Reema, 2013). Many of the proteins are harmless to humans, but some are toxins. Besides the snake venom contains inorganic cations such as sodium, calcium, potassium, magnesium and small amounts of zinc, nickel, cobalt, iron and manganese (Sonia and Reema, 2013). Snake venom is harmless if ingested in liquid or crystal form after drying through mouth and it will be excreted unchanged. It produces toxicity only if contacted with blood (Vyas, 2013).

5. Medicinal uses of snake Venom

Snake venoms are the complex mixture of several biologically active proteins, enzymes, peptides and organic and inorganic compounds. Venoms from snakes is an important agent which can be used in the treatment of cancer, arthritis, thrombosis, multiple sclerosis, pain, neuromuscular disorders, blood and cardiovascular disorders, infections and inflammatory diseases (Freek *et al*., 2011). The cytotoxic effects of snake venom have potential to destroy tumor cancer cells. Khusro and Aarti (2013) and Goswami *et al*. (2014) reviewed that snake venom acts by inhibiting cell proliferation and causing cell death (Khusro and Aarti, 2013; Goswami *et al*., 2014). Snake venom provides various therapeutic. Snake venom has fibrinogenolytic and fibrinolytic activity, and this therapeutic action of snake venom can widely be used in treatment of stroke, deep vein

thrombosis, cerebral infarction, myocardial infarction, peripheral atrial thrombosis, priapism, and sickle cell crisis (Pal *et al*., 2002).

References

Bieber, A. L. (1979). Snake venoms: Metal and non-protein constituents in snake venoms. Springer-Verlag Vol. **52**: 295-306.

Ethiopian Biodiversity Institute (EBI) (2014). Government of the Federal Democratic Republic of Ethiopia, 5th National Report to the Convention on Biological Diversity, Addis Ababa, Ethiopia. pp. 1-72.

Freek, J.V., Kate, J., Robin D., Frank M., Mirtschin, P.J. and Nicolas, V. (2011). Snake venom from fieldwork to the clinic. Bioessays-journal.com. **33**: 269–279.

Goswami, P.K., Samant, M. and Srivastava, R.S. (2014). Snake venom, Anti-snake venom and Potential of snake venom. *International* ***Journal*** *of Pharmacy and Pharmaceutical Sciences* **6** (5): 4-7.

Hezron, E.N. and Alex, H. (2015). Assessment of human-snake interaction and its outcomes in Monduli District, northern Tanzania, Sokoine University of Agriculture. Tanzania *Journal of Health Research* **17**:1.

Khusro, A. and Aarti, C. (2013). Snake venom as Anti-cancer agent: Current Perspective. *International Journal of Pure and Applied Bioscience* **1** (6): 24-29.

Largen, M.J. and Rasmussen, J.B. (1992). Catalogue of the snakes of Ethiopia (Reptilia Serpentes), including identification keys. *Tropical Zoology* **6**: 313-434.

Living Hazards Database (LHD) (2013). Living Hazards Database Search by Country. Retrieved from http://www.toxinology.com.

Mirtschin, P.J., Dunstan, N., Hough, B., Hamilton, E., Klein, S.and Lucas, J. (2006). Venom yields from Australian and some other species of snakes. *Ecotoxicology* **15**: 531–538.

Nuru Adgaba (2002). **Geographical races of the Honeybees (*Apis mellifera* L.) of the Northern Regions of Ethiopia.** PhD Dissertation. Rhodes University, South Africa.

Pal, S.K., Gomes, A., Dasgupta, S.C. and Gomes, A. (2002). Snake venom as therapeutic agents: From toxin to drug development. *Indian J. Experimental Biology* **40**: 1353- 1358.

Pingale, S.S., Bendbhar, R.D., More, B.P., Malve, M.K. and Khot, B.R. (2014). Snake venom - Facts Figures and Social perspective. *World Journal of Pharmaceutical Research* **3** (7): 616-620.

Sonia, S. and Reema, G. (2013). Therapeutic Potential of Snake Venom. *International journal of Pharmacy* **4** (11): 9-16.

Spawls, S., Howell, Kim, Hinkel, H., and Menegon, M. (2018). **A Field Guide to East African Reptiles.** 2nd ed. Bloomsbury Natural History, London, Sidney.

Vyas, V., Brahmbhatt, K., Bhatt, H. and Parmar, U. (2013). Therapeutic potential of snake venom in cancer therapy: Current perspectives. *Asian Pac. J. Trop. Biomed.* **3**(2): 156-162.

Wikipedia (2019). **Naja.** Wikipedia, the Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Naja.