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CONTRIBUTIONS TO A REVIEW OF PHILIPPINE SNAKES, VII

THE SNAKES OF THE GENERA NAJA AND OPHIOPHAGUS

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THE SNAKES OF THE GENERA NAJA AND OPHIOPHAGUS

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TWO TEXT FIGURES

Few animals have excited the imagination, and fears, of people more than these remarkable animals. The cobras are in fact, as they are in fiction, dangerously venomous animals and bear a major responsibility for deaths caused by snake bite in Asia [Reyes and Lamanna (1955)]. They are widely distributed throughout southeastern Asia, western Indonesia, and the Philippines. In the Philippines they have been taken on most of the major islands of the Archipelago though *Naja naja* has not been found in the western Visayan Islands, which raises a number of interesting zoogeographic problems (to be discussed in a later paper in this series), while *Ophiophagus hannah* has only recently been taken on Negros Island, but not Cebu or Panay of the western Visayan group.

The populations of *Naja naja,* in the Philippines, fall into three clearly distinguishable groups and for reasons to be given below are accorded the taxonomic rank of subspecies. *Ophiophagus hannah,* based on very limited material, appears to be monotypic.

TERMINOLOGY

Standard length: Distance from tip of snout to anal opening. Measurements given under "Diagnosis" are for largest specimen of each sex studied.

Tail length: Distance from anal opening to tip of undamaged tail.

*: [asterisk] following locality listed under "Range" indicates sites from which specimens were examined.

19 (–5[108–110]) 17: Dorsal scale reduction formula indicates a reduction from 19 to 17 longitudinal rows of scales by loss of the fifth row on each side between ventrals 108 to 110. Caudodorsal scale reductions determined by level of subcaudal shield opposite which reduction takes place.

ACKNOWLEDGMENT

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Genus NAJA Laurenti

Naja LAURENTI (1768) 90 (type species *Coluber naja* Linnaeus, by monotypy).

Uraeus WAGLER (1830) 173 (type species *Coluber haje* Linnaeus, by monotypy).

Aspis [nec Laurenti (1768) Reptilia] WAGLER (1830) 173 (type species *Naja naja* [= *Coluber naja* Linnaeus], by reason of the fact that all nominal species listed by Wagler under this nominal genus are conspecific).

Tomyris EICHWALD (1831) 171 (type species *Tomyris oxiana* Eichwald, by monotypy).

Definition.—Maxillary bone extending forward beyond palatine; venom fangs moderately short, followed by from 0 to 2 small teeth; pterygoid with 13 to 19 small teeth; eye moderate, pupil round; nasal large, nostril between two nasals; loreal absent; scales smooth, in 19 to 25 longitudinal rows at midbody (for Asian species only); hypapophyses present posterior dorsal vertebræ; hemipenes relatively short, forked for less than half their length, variously spinose throughout.

Remarks.—A single polymorphic species of *Naja* occurs in Asia. Bogert [(1943) 290–292] intimates that, based on our present knowledge, the recognition of subspecies of *Naja naja* cannot be accomplished reasonably. This conclusion is, in part, based on an examination of "several Philippine specimens of *Naja* with diverse coloration and patterns" which fail to disclose "any difference that might be regarded as being of specific [=? subspecific] value." Smith [(1943) 247–436] demonstrated the existence of three distinct subspecies of *Naja naja* in the Indian-Indo-Chinese region, and Taylor [(1922a) 259–268] clearly showed the presence of three geographically distinct populations of that species in the Philippine-Bornean region (which he subsequently thought should be raised to the rank of full species [(1934) 309].

I have followed Taylor's [(1922a) 259–268] treatment of *Naja naja* in the Philippines since our findings are in accord.

Key to the Philippine subspecies of Naja naja

1a. Scales at midbody in 19 or 17 longitudinal rows; above, ground color black or very dark brown.
  2a. A few of the anterior ventrals are light yellow followed by a band of black which gradually fades posteriorly; ventrals 162 to 178 ..... *N. n. samarensis*
  2b. Venter dark or light but without any distinctive black band on anterior portion; ventrals 178 to 189 ..... *N. n. miolepis*
1b. Scales at midbody in 21 to 23 longitudinal rows; above ground color uniform light brown or olive brown; ventrals 177 to 196. *N. n. philippinensis*

NAJA NAJA (Linnæus).

Coluber naja LINNÆUS (1758) 221 [based on Seba, Thes. 1 (1734) pl. 44, figs. i and ii; pls. 85, fig. i, 89, figs. 1–4, 90, figs. 1–2, 97, fig. 104; type locality "Habitat in India"; original description].

Taxonomic notes.—In the Philippines three distinct geographical populations may be recognized. These are: *Naja naja miolepis* (Boulenger), *Naja naja philippinensis* Taylor, *Naja naja samarensis* Peters.

The presently recognized subspecies of *Naja naja* present a confusing array of poorly defined "color varieties." Unfortunately, in the past, little attention was given to the distribution of these color varieties and to the problems of intrapopulation variation. Smith [(1943) 427–436], based in part on the findings of Wall (1925), recognized three subspecies. He pointed out that any attempt to define populations of *Naja naja* in the Indo-Chinese region on the basis of color pattern is fruitless. On the other hand, the color pattern on the hood and scale reductions could be correlated with distribution.

In the Philippines, color pattern differences were found to correlate very closely with distribution. There is no difficulty in recognizing Philippine populations on this basis, although it is evident that elsewhere color and color pattern are not useful taxonomic characters. Also correlated with distribution are differences in scale counts and dorsal scale reductions.

At the present time the most difficult problem lies in the separation and definition of populations in the Malay Peninsula and Indonesia. From the latter region, at least six subspecies of *Naja naja* have been recognized [Haas (1950) 598–600]. Of these, three are said to be sympatric on Borneo and three

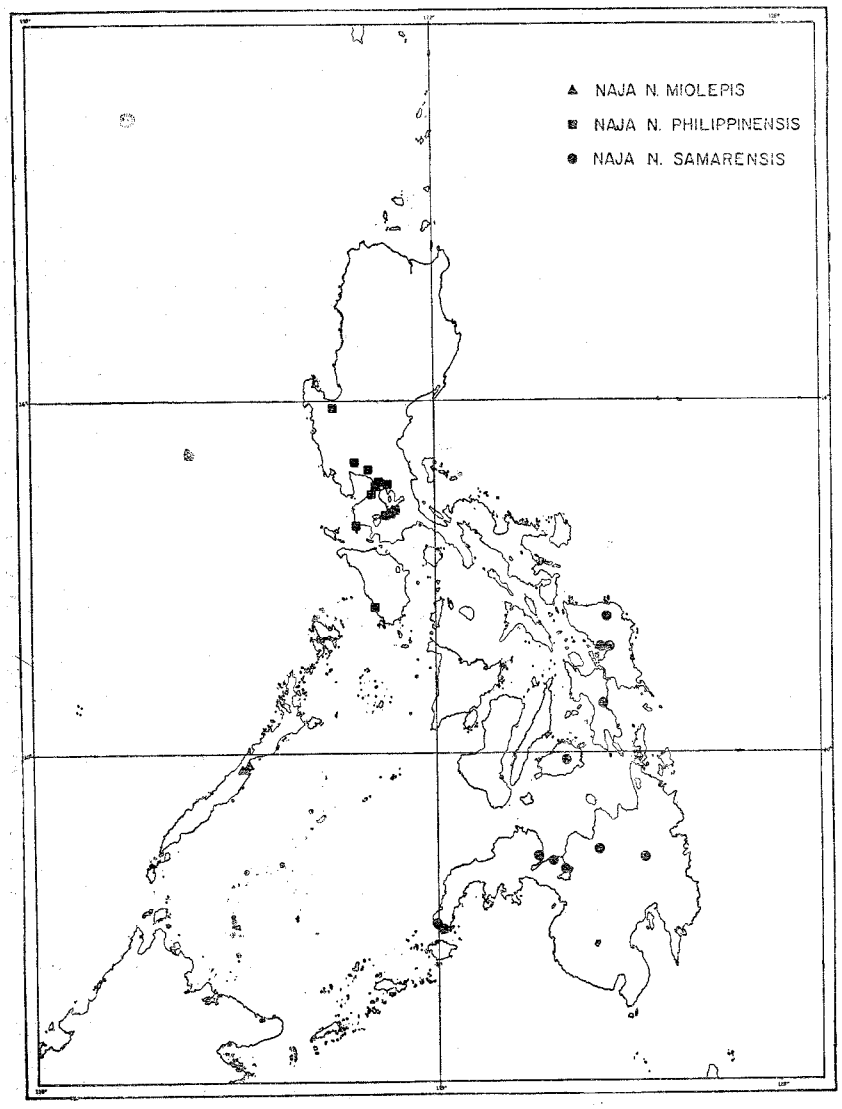

FIG. 1 Distribution of cobras in the Philippines

on Sumatra. It is evident that the Indonesian populations are in serious need of attention.

One point should be kept in mind in any attempt to study and delimit populations of *Naja naja*. Characters that are found to be taxonomically useful in distinguishing populations in one part of this species enormous range may not necessarily be equally as useful as in another part of the range. There is considerable variation in color and color pattern among speci-

mens even from a single locality in the Indo-Chinese region, but in the Philippines color pattern differences are definitely stable and can be correlated with distribution. It is therefore obvious that characters which are phenotypically (and presumably genetically) stable in one population may show a remarkable degree of phenotypic variability elsewhere. Furthermore, there is always a possibility, however remote, for parallel mutations to occur in closely similar genetic systems in otherwise geographically isolated populations so that, on the basis of any one character, diverging populations may appear quite similar.

Description.—Rostral broader than deep, penetrates between internasals; prefrontals larger than internasals; frontal about as long as broad, slightly wider than large supraoculars, two-thirds as long as parietals; nasal large, anterior portion largest, with very large elliptical nostril; loreal absent, preocular and nasal in contact; 1 preocular; 3 postoculars, rarely 2; 2 large anterior temporals; 2 to 4 posterior temporals; 7 upper labials, third higher than others, third and fourth bordering eye; 8 lower labials, first pair in contact behind mental, first four in contact with anterior chin shields; scales in 17 to 21 longitudinal rows at midbody (for Philippine populations only [see p. 536 for scale reduction patterns]; ventrals and subcaudals, see Tables 1 and 2; anal plate single.

Hemipenes extending to tenth subcaudal plate, forked at end of sixth plate; sulcus spermaticus forked; proximal third with minute spines, which end abruptly; median third with much enlarged spines and a narrow transverse band which is without spines; distal third with irregular, poorly shaped calyces, the edges of which are set with minute spines.

Color (in alcohol) above light to dark brown, with or without narrow cross bands; below yellow to dark gray with or without a black band on the anterior fifth of the venter. Young colored as adults except that light cross bands on dorsum, when present, more distinct.

Inter-island variation.—Differences among geographically distinct populations in the Philippines are very marked. The most strikingly distinct variation is in color pattern and color. The Luzon and Mindoro samples, which both Taylor and I have studied, are consistently light brown to olive brown. Except for a very indistinct reticulation of lighter and darker brown no markings, either lighter or darker in color, are present. The

ventral color is similar to that of the dorsum but somewhat lighter.

Specimens from the southern islands, excluding the western Visayan group (Negros, Cebu and Panay from which islands *Naja naja* has not been taken) are dark brown to black above, with an indistinct reticulum of narrow yellowish markings. A light line on the outer two scale rows is usually present, especially distinct in young specimens. Below, the throat and first five to ten ventrals are yellowish followed by a black band of twenty or more ventrals in width which becomes lighter posteriorly, grading into a gray and then yellowish color. There are no crossbands on the dorsum, even in young specimens.

The sample from Palawan includes both young and adults. The latter are dark brown to black above and dark gray below, except for sides of head and throat which are yellowish brown and which gradually grade into the darker ventral color. The young are also dark brown to black above. In addition, there are a series of 10 to 12 light yellowish bands on the dorsum and two to five bands on the tail. Behind the head is a distinctive chevron-shape crossband whose apex points backwards.

Variation among the samples studied in scale characters are not as striking as that of color pattern, but nevertheless some differences can be correlated with distribution.

The northern samples from Luzon and Mindoro have rather consistently 21 longitudinal scale rows at midbody. Reduction from 21 to 19 rows takes place by loss of the fifth scale row at the level of the 110 to 120 ventral plate. In the samples from the southern islands, excluding Palawan, there are consistently 19 scale rows at midbody (if the count is made exactly at midbody; frequently 17 scale rows if the count is made just beyond midbody). Reduction from 21 to 19 rows takes place near the head, at the level of ventral shields 18 to 20; reduction from 19 to 17 takes place just beyond midbody, at the level of ventrals 94 (in a snake with 165 ventrals). The reduction takes place by loss of the fifth scale row, so it is similar in kind to the scale reduction in the northern samples.

The Palawan sample agrees most closely with the scale reductions noted in the Luzon-Mindoro samples. In one point they differ. In the Palawan sample reduction from 17 to 15 scale rows takes place almost immediately following the re-

duction from 19 to 17 rows: 19 (–5 [108–110]) 17 (–5 [116–118]) 15; in the sample from the northern islands, however, reduction from 17 to 15 is delayed to the 145 to 160 ventrals: 19 (–5 [112–131] 17 (–5 [145–160]) 15. Furthermore, the scales reduce to 13 rows in the Palawan population at the same level that they reduce to 15 rows in the Luzon-Mindoro population. In the latter there are no further reductions, so the terminal number of body scale rows is 15. Reductions in the Mindanao-Samar population follow more closely the pattern of reductions in the population from Palawan.

A comparison of ventral counts (Table 1) reveals that the Mindanao-Samar population is characterized by a lower number of ventral shields in both sexes than either Palawan or Luzon-Mindoro populations. Differences in subcaudal counts (Table 2) cannot be correlated with geographically distinct populations but rather seem to be influenced by a north-south cline. The average number of subcaudal shields reduce from south to north, although there is considerable overlap in the range for each of the island samples.

TABLE 1.—*Summary of the variation in the number of ventral shields in Naja naja.*

Island	N *	Male mean	Range	N *	Female mean	Range
Palawan	4	181.5	180–184	3	186.0	183–189
Mindanao	7	171.0	165–175	6	174.3	168–178
Samar	3	164.7	163–166	2	171.5	168–175
Leyte				1	173.0	
Bohol	2	162.5	162–163			
Mindoro				2	189.0	189
Luzon	9	184.9	177–191	8	187.4	180–191

* Includes counts given by Taylor [(1922a) 261, 264, 267] in part.

TABLE 2.—*Summary of the variation in the number of subcaudal shields in Naja naja.*

Island	N *	Male mean	Range	N *	Female mean	Range
Palawan	4	48.8	46–51	3	48.7	47–50
Mindanao	6	46.7	45–50	6	45.0	42–49
Samar	3	47.7	47–48	2	45.5	43–48
Leyte				1	46	
Bohol	2	45.5	45–46			
Mindoro				2	**	
Luzon	9	43.5	41–48	8	40.4	38–47

* Includes counts given by Taylor [(1922a) 261, 264, 267] in part.

** Tails damaged.

Sexual dimorphism—In spite of the fact that there is complete overlap in the range of counts for ventrals, subcaudals, and the tail length/standard length ratio between sexes in the Philippine populations, there are nevertheless slight differences in the averages of those counts. Similar degrees of difference are found among all samples studied. From this it is concluded that, regardless of the magnitude of the difference between means, the differences are in fact significant and reflect sexual dimorphism in those characters. Variations between sexes are discussed further under the respective subspecies.

NAJA NAJA MIOLEPIS (Boulenger).

Naja tripudians miolepis BOULENGER (1896) 384 (type locality Sarawak, Borneo [see below]; type in British Museum; original description).

Naja naja miolepis GRIFFIN (1909) 600 (Palawan [Iwahig]; listed), (1911) 266, 268 (Palawan listed in key); Taylor (1922a) 262, pl. 32, fig. 30a-c (Palawan; synonymy, description, variation, counts and measurements of material examined); HAAS (1950) 599 (listed from Palawan).

Naja tripudians miolepis DE ROOIJ (1917) 248 (listed from Palawan; description, distribution).

Naja tripudians caeca (*nec* Gmelin) GRIFFIN (1909) 600 (in part; Palawan [Iwahig]; listed), (1911) 266 (in part; Palawan; listed in key).

Range.—(Philippine localities only.) PALAWAN: Iwahig; Puerto Princesa *.

Material examined (5).—BORNEO: Mt. Kina Balu [Bunda Tuhan] (USNM 130245). PALAWAN: Puerto Princesa (CAS 15813); without exact locality (CAS 62147 and 62148). PHILIPPINES: doubtfully said to have come from Mindanao (CAS 15333).

Taxonomic notes.—Boulenger [(1896) 384] had before him specimens from Palawan and Sarawak and elsewhere in Borneo when he described this subspecies. Haas states that the type locality is "Sarawak ?". The questioned selection of a type locality by Haas leaves the question of type locality in doubt. To clarify this matter I hereby select Sarawak, Borneo, as type locality.

Diagnosis.—Color above dark brown to black, below yellowish to gray but without any distinctive black band on anterior portion of venter; scales in 19 longitudinal rows at midbody; ventrals 178 to 189. Standard length: (♂) 1,227 mm, (♀) 1,057 mm; tail length (♂) 177 mm, (♀) 150 mm.

Supplemental description.—Scales in 23 longitudinal rows around neck, 19 rows at midbody, 13 rows just before vent; ventrals 178 to 189; subcaudals 46 to 51; anal plate single.

Sexual dimorphism.—Males average fewer ventrals than females, but there are no differences in subcaudal counts. In spite of the similarity in subcaudal counts, males seem to have longer tails than females (based on a comparison of individuals of the same standard lengths and on a comparison of the ratio of tail length/standard length).

Among the young specimens examined, one female had 10 narrow cross bars on the body, two males had 12 each.

In Table 3 what is known of sexual dimorphism in this subspecies is summarized.

TABLE 3.—*Summary of the variation between sexes in Naja naja miolepis.*

Character	N *	Male mean	Range	N *	Female mean	Range
Ventrals	4	181.5	180–184	4	186.0	183–195
Subcaudals	4	48.8	46–51	3	48.7	47–50
Tail length/standard length	4	0.173	0.167–0.183	2	0.149	0.142–0.156
Cross bars on body	2	12.0	12	2	11.0	10–12

* Includes several records from Taylor [(1922a) 264].

NAJA NAJA PHILIPPINENSIS Taylor.

Naia tripudians caeca BOULENGER (1896) 383 (in part; Luzon [highlands of Lepanto]; specimen listed with counts).

Naja tripudians caeca BOETTGER, (1898) 121 (in part; Luzon; listed).

Naja naja caeca GRIFFIN (1911) 266 (in part; Luzon [Manila]; listed in key).

Naja naja caeca GRIFFIN (1911) 266 (in part; Luzon [Manila]; listed in key).

Naja naja philippinensis TAYLOR (1922a) 265 (type locality Manila, Luzon Island; type destroyed, formerly in Bureau of Science, Manila; synonymy, description, variation, counts and measurements of material examined; additional specimens listed from Manila, Los Baños, Pangasinan, and Pampanga, Luzon Island), (1922c) 301 (Luzon [Los Baños; near Antipolo]; counts and measurements), (1922d) 139 (Luzon [Mt. Makiling]; listed), (1934) 309 (believes *N. n. philippinensis* should be considered a distinct species).

Range.[5]—LUZON.[6] Batangas Province (Calatagan*); Bulacan Province (Bulacan*); Cavite Province (Bacoor*); Laguna

[5] A single sepimen was recorded by Taylor [(1922a) 267] from Palawan Island. This specimen was said to have been collected by C. M. Weber, a resident of that island. I doubt that this subspecies occurs there. It has not been collected since the one specimen was said to have been obtained there, although other cobras have been found frequently. I suspect that there was a confusion in locality data.

[6] Boulenger [(1896) 383] listed a single specimen from the "highlands of Lepanto," a locality that cannot be located on any map available to me.

Province (Laguna de Bay*; Los Baños; Mt. Makiling); Pampanga Province; Pangasinan Province*; Rizal Province (Antipolo*; Manila; San Juan*). MINDORO: Mangarin*.

Material examined (*11*).—LUZON: Bulacan Province: Bulacan (CAS 15336); Batangas Province: Calatagan (SU 8583); Cavite Province: Bacoor (SU 12421); Laguna Province: Laguna de Bay (CM 2570); Pangasinan Province: without exact locality (CAS 61816 and 61817, paratypes; CAS 61818); Rizal Province: Antipolo (CAS 61808); San Juan (CAS 15337). MINDORO: Mangarin (SU 12295 and 12417).

Taxonomic notes.—The type specimen of this subspecies was destroyed during World War II when the Bureau of Science building in Manila was burned. I have refrained from designating any of the paratypes, of which there are several available, as neotype because the individuals are all juveniles and because Taylor's description adequately characterizes this unique population of *Naja naja.*

In 1934, Taylor wrote:

> It is probable that *Naja naja philippinensis* Taylor should be regarded as a distinct species unless it can be shown that a similar form occurs in Borneo; otherwise it represents a case of discontinuous distribution from its near relatives in Sumatra and Java. That it is not a subspecies of the Borneo-Palawan species *Naja miolepis* Boulenger is proven by the occurrence of the species side by side throughout Palawan. Whether *philippinensis* occurs in the large island of Mindanao, Leyte, and Samar, the habitat of *Naja samarensis* Peters, is not known. [Taylor (1934) 309.]

At the time Taylor wrote this paragraph, he noted that he had formerly treated these forms as subspecies; he then stated, ". . . but they are, I now believe, certainly worthy of specific rank." [Taylor (1934) 309, footnote.]

I have already indicated that in my opinion the Philippine populations are quite evidently subspecies of the widely distributed *Naja naja.* I question Taylor's reasons for suggesting that *N. n. philippinensis* be elevated to specific rank. It was based on the assumption that that subspecies and *N. n. miolepis* are sympatric on Palawan Island. A single specimen, assigned to *N. n. philippinensis* by Taylor, is said to have come from there. That island has been visited by a number of collectors, both before and since Taylor's work there, and although they have obtained a fair sampling of the cobras that live there, no other specimen of *N. n. philippinensis* has been taken, to the

best of my knowledge. I believe that the locality datum which accompanied the specimen Taylor had before him was in error.

Diagnosis.—Color above light brown to olive brown, below lighter cream to yellowish brown, without any distinctive cross bands above or below either in young or adult stages; scales in 21 longitudinal rows at midbody; ventrals 181 to 191. Standard length: (♂) 1,223 mm, (♀) 960 mm; tail length: (♂) 189 mm, (♀) 195 mm.

Supplemental description.—Scales in 23 to 25 longitudinal rows around the neck, 21 rows at midbody, 15 rows just before the vent; ventrals 181 to 191; subcaudals 38 to 47; anal plate single.

Sexual dimorphism.—The differences between sexes are slight. Males average a few more ventrals, more subcaudals, and a slightly-longer tail (tail length/standard length) than females. In each case the range of variation is almost identical. Although the difference between sexes are slight (Table 4), I suspect that the study of larger samples will confirm their significance.

TABLE 4.—*Summary of the variation between sexes in Naja naja philippinensis.*

Character	N *	Male mean	Range	N *	Female mean	Range
Ventrals	9	185.9	181–191	9	187.5	185–191
Subcaudals	9	43.3	40–47	8	40.4	38–47
Tail length/standard length	7	0.154	0.146–0.174	7	0.144	0.134–0.157

* Include several records from Taylor [(1822a) 267].

Ecological notes.—Taylor [(1922a) 266] reported on a female that he had kept in the laboratory which subsequently laid a clutch of eggs. These were kept buried in moist earth. After about 49 days' incubation they hatched. Kopstain [(1938) 116] reported that the incubation of the eggs of *N. n. sputatrix* lasted about 88 days before hatching. The lengths of the newborn were not given by Taylor. Kopstein noted, however, that his newborn cobras measured about 284 mm in total length. Following birth the young undergo a period of very rapid growth, one specimen reported on by Kopstein having attained a total length of 872 mm after eight and a half months. If the growth rate is similar for the young of *N. n. philippinensis*, then the specimens recorded by Taylor in his Table 57 [(1922a) 267], which were hatched in the laboratory, must have been

about six weeks old [a fact confirmed by Taylor (1922a) 268].

These snakes apparently accept frogs as well as snakes in their diet, and Taylor noted that tadpoles served well as food for his newly hatched young.

NAJA NAJA SAMARENSIS Peters.

Naja tripudians GÜNTHER (1858) 225 (in part, var. F; Philippines); (1879) 78 (Mindanao, Leyte; listed).

Naja tripudians samarensis PETERS (1861) 690 (type locality Loquilocum, Samar Island; type in Berlin Museum; original description); BOETTGER (1886) 116 (distribution compiled).

Naja samarensis BOULENGER (1896) 385 (northern Mindanao, southern Leyte; description); BOGERT (1943) 292 ("This form, without better grounds for retaining it as a subspecies of *Naja naja*, had best be referred to the synonymy of the latter . . .").

Naja samarensis BOETTGER (1898) 122 (Samar; listed); GRIFFIN (1911) 266 (Samar; distribution compiled; listed in key); Taylor (1922a) 259 (Mindanao [Bunawan], Samar [Catbalogan]; synonymy, description, color in life, variation, counts and measurements of material examined), (1922b) 163 (Mindanao [Tumugao River, Zamboanga Province]; listed) (1922c) 302 (Mindanao [Tumugao River area]; counts and measurements), (1934) 309 (believes this form should be a full species).

Naja sputatrix (*nec* Schlegel) MÜLLER (1883) 289 (Mindanao; listed); BOETTGER (1886) 116 (Mindanao; listed).

Naja naja sputatrix GRIFFIN (1911) 268 (stated to be a synonym of *N. n. miolepis*).

Range.—BOHOL: Sierra Bullones (Sandayong Sitio*). LEYTE: vicinity of Tarragona*. MINDANAO: Agusan Province (Bunawan); Bukidnon Province (Del Monte Plantation*); Lanao Province (Lake Lanao*, Maigo*); Misamis Occidental Province (Misamis*); Zamboanga Province (San Ramon*, Tumugao River, Zamboanga City*). SAMAR: Catubig*, Catbalogan, Loquilocun.

Material examined (*22*).—BOHOL: Sierra Bullones: Sandayong Sitio (SU 18782, 18899). LEYTE: 1 mile north of Tarragona (USNM 121606). MINDANAO: Bukidnon Province: Del Monte Plantation (SU 8672, 12422 and 12423, 12961 and 12962); Lanao Province: Lake Lanao (CAS 15334), Maigo (SU 18468); Misamis Occidental Province: Misamis (SU 12956 and 12957); Zamboanga Province: San Ramon (SU 12424 to 12426, 12958); Zamboanga City (CAS 62040, SU 12959). SAMAR: Catubig (USNM 53530); without exact locality (SU 12960, USNM 36423 and 36424).

Diagnosis.—Color above dark brown to black, usually with a trace of a light lateral line, at least anteriorly, on outer two scale rows; below color of throat and first few ventrals yellowish followed by a distinct broad black crossbar which posteriorly becomes lighter; scales in 19 longitudinal rows at midbody; ventrals 162 to 178. Standard length: (♂) 843 mm, (♀) 921 mm; tail length: (♂) 158 mm, (♀) 155 mm.

Supplemental description.—Scales in 23 or 21 longitudinal rows on the neck, 19 rows at midbody, and 13 rows just before the vent; ventrals 162 to 178; subcaudals 42 to 50; anal plate single.

Sexual dimorphism.—Consistent with the variations noted between sexes in other Philippine populations of *Naja naja,* males average fewer ventrals, more subcaudals, and a higher tail length/standard length ratio than females. The data are summarized in Table 5.

TABLE 5.—*Summary of the variation between sexes in Naja naja samarensis.*

Character	N *	Male mean	Range	N *	Female mean	Range
Ventrals	12	168.0	2–175	8	173.9	168–178
Subcaudals	11	47.1	45–50	8	45.1	42–49
Tail length/standard length	9	0.191	0.17 0.218	6	0.180	0.168–0.195

Inter-island variation.—The principal differences among samples from the several islands are in ventral and subcaudal counts. The northern samples (*i.e.* including Samar, Leyte and Bohol) average fewer ventrals and subcaudals than the Mindanao sample. These differences are thought to reflect the effects of latitudinal distribution.

Ecological notes.—According to Taylor [(1922a) 262] individuals were seen during the daytime crawling about on the forest flow or in front of his house at Bunawan, Agusan Province, Mindanao.

The snake is said to eat frogs and other snakes. According to Taylor [(1922a) 262] a specimen in captivity readily accepted *Calamaria gervaisii.* Gressitt (1937) reported on one individual whose stomach contained the remains of several marine mammals. A single specimen I examined had four newly born young of some rodent in its stomach.

Nothing seems to be known of the breeding habits of this snake. I have examined several specimens, between 247 and

283 mm in standard length, believed to be newly born. All were collected during August and early September, 1940, on Mindanao. If it may be assumed that the minimum incubation period is about 50 days (see discussion under *N. n. philippinensis*), then the eggs from which these young were hatched must have been laid sometime in June or early July.

Genus OPHIOPHAGUS Günther

Hamadryas [*nec* Hubner (1806) Lepidoptera] CANTOR (1836) 87 (type species *Hamadryas hannah* Cantor, by monotype).

Ophiophagus GÜNTHER (1864) 341 (type species ***Ophiophagus elaps*** Günther, by monotypy).

Definition.—Maxillary bone extends forward beyond palatine; venon fangs short, followed by three small teeth; pterygoid teeth 10 to 12; head barely distinct from neck; eye moderate pupil round; nasal large, nostril between two nasals; loreal absent; scales smooth, in 15 longitudinal rows at midbody; subcaudals partially single and partially paired; hypapophyses present on posterior dorsal vertebræ; hemipenes very elongate, forked for most their length.

Remarks.—Wall [(1925) 820] suggested that the king cobra should be placed in a distinct genus because the hemipenes "... is so markedly different from... these organs in the cobra (*Naia naia* [*sic!*]) ..." Bogert (1943) has very clearly demonstrated the distinctness of the king cobra from other groups of cobras. In external appearance it closely resembles *Naja naja* but differs so strikingly in the structure of the hemipenes and in dentition that it must be referred to a separate genus.

Bogert [(1945) 47] pointed out that Cantor's nominal genus *Hamadryas* is preoccupied; consequently Günther's later name, which is rather apropos of the king cobra's dietary habits, must be used.

OPHIOPHAGUS HANNAH (Cantor).

Hamadryas hannah CANTOR (1936) 187, pls. 10–11 (not seen; type locality Sandarbans, near Calcutta, India; type [s] unknown; original description).

Naja hannah TAYLOR (1922a) 256, pl. 31, figs. 2–3, text-fig. 29 (Balabac, Luzon [Baguio], Mindoro, Palawan; synonymy, description, variation, counts and measurements of material examined), (1922d) 139 (Luzon [Mt. Makiling]; listed); POPE (1935) pl. 16, figs. A-B (listed from Philippines; description, hemipenes, ecological notes; SMITH (1943) 436, text-fig. 140 (listed from *Philippines;* synonymy, description, ecological notes).

Naia hannah BOURRET (1936) 399, text-fig. 159 (listed from Philippines; extensive synonymy, description, ecological notes).

Naja bungarus SCHLEGEL (1837) 476, pl. 17, figs. 8–9 (type locality Sumatra; type in Leiden Museum; original description); PETERS (1861) 690 (Labúan; listed); BOETTGER (1898) 122 (Central Luzon; listed); GRIFFIN (1909) 600 (Luzon, Palawan [Iwahig]; listed), (1911) 266 (Luzon [Benguet; Laguna], Palawan; distribution otherwise compiled; listed in key).

Trimeresurus bungarus JAN (1873) Livr. 44, pl. 4.

Naia bungarus BOULENGER (1890) 392, text-fig. 114 (listed from Philippines; synonymy, description), (1896) 386 (Luzon [Isabela]; synonymy, description, counts of material examined, distribution); FLOWER (1899) 691 (listed from Philippines; synonymy, distribution, size).

Hamadryas elaps GÜNTHER (1858) 219 (type locality not designated, specimens from Philippines and Borneo; types in British Museum; original description); FISCHER (1885) 81 (southern Mindanao; listed).

Ophiophagus elaps GÜNTHER (1864) 341 (listed from Philippines; synonymy, description, color pattern variation); BOETTGER (1886) 116 (Mindanao; listed).

Naja (*Hamadryas* ?) *fasciata* PETERS (1861) 689 (type locality Samar Island; type in Berlin Museum; original description).

Ophiophagus fasciatus BOETTGER (1886) 117 (locality data said to be after Peters (1861) but in error; listed).

Range.—(Philippine localities only.) BALABAC. JOLO*. LUZON: Benguet Subprovince (Baguio*); Isabela Province (Isabela); Laguna Province (Mt. Makiling). MINDANAO: southern part of island, without exact locality data. MINDORO. NEGROS: ridge on south side of Maite River*. PALAWAN: Iwahig.

Material examined (*4*).—JOLO: without exact locality (SU 13327). LUZON: Benguet Subprovince: Baguio (CAS 61329). NEGROS: Oriental Negros Province: ridge on south side of Maite River (SU 18195). MALAYA: Singapore (CAS 16785).

Taxonomic notes.—So much has been written about this snake that little can be added here. I have followed Bogert (1943) and placed this snake in a distinct genus.

Bogert [(1943) 304] suggested that dental characters might provide a basis for the segregation of species or subspecies of the king cobra. Neither Bogert nor I have seen adequate samples of this snake to investigate this possibility. Boulenger's varieties [(1896) 386–387] appear to have been based on snakes of different age groups, a fact already noted by Taylor [(1922a) 258].

Description.—Rostral more broad than deep; internasals almost square slightly narrowed anteriorly and slightly smaller

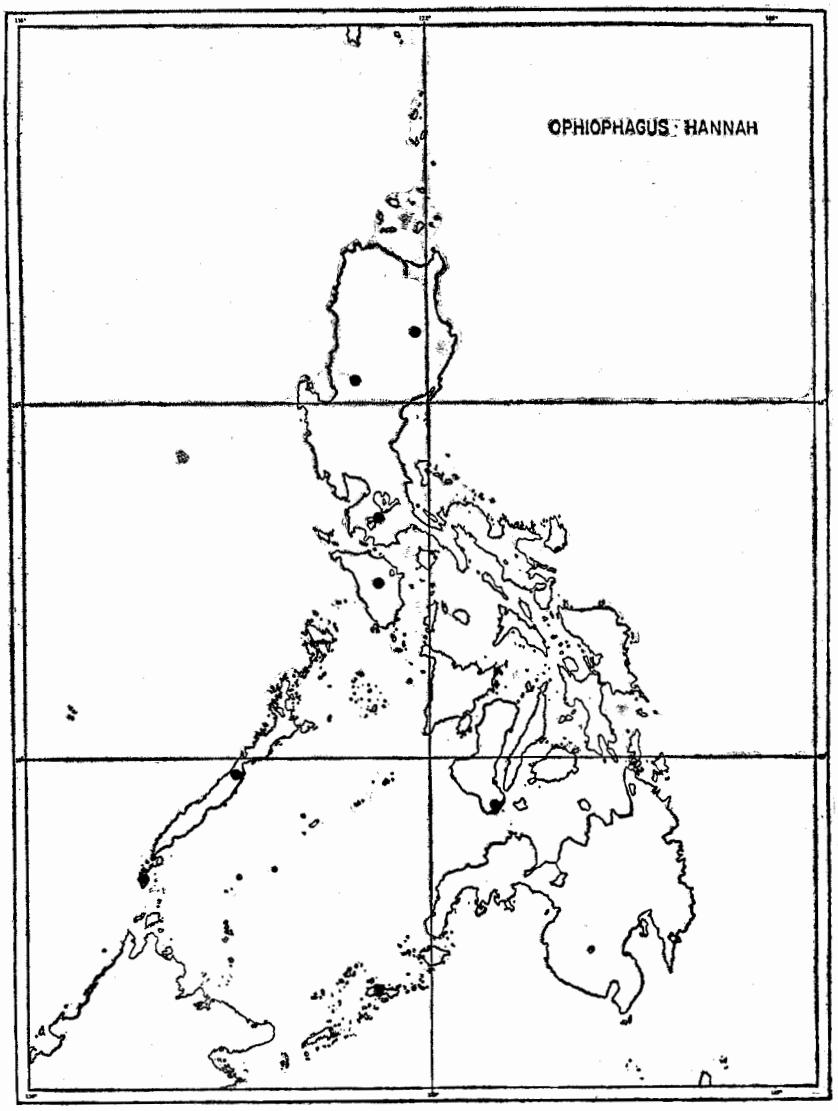

FIG. 2. Distribution of *Ophiophagus hannah* in the Philippines. Records for Mindanao and Mindoro are without exact localities.

than prefrontals; frontal cone-shaped, not as wide as supraocular, much shorter than parietals; 2 large postparietal [=occipital] shields, bordered by posterior temporals; nasal very large, divided, in contact with first 3 upper labials, with large nostril; no loreal; 1 preocular; 3 postoculars; 2 very large anterior temporals; 2 posterior temporals; 7 upper labials, third and fourth bordering eye; mental broader than deep; 8 or 9 lower labials, the first pair in contact behind mental,

first four in contact with anterior chin shields; posterior chin shields about as long as, but narrower than, anterior pair; scales in 15 longitudinal rows throughout; caudodorsal scales reduce: 6 (2+3 [43–46]) 4; ventrals and subcaudals see Table 1; anal plate single.

Hemipenes extending to twenty-eighth subcaudal plate, forked opposite fourth subcaudal plate; *sulcus spermaticus* forked; short unforked portion with few spines; walls of forked portions ornamented with closely packed transverse flounces which near distal tip grade into small calyces.

Color (in alcohol) uniform yellowish to dark olive brown above, with indistinct narrow whitish reticulations formed when the interstitual skin is stretched and visible; young individuals are brown to black above with narrow, whitish, chevron-shaped transverse bars on the dorsum and four transverse bars on the head; these bars are lost in adults.

Standard length: (♂) 1,610 mm, (♀) 1,590 mm; tail length (♂) 430 mm, (♀) 395 mm.

TABLE 6.—*Summary of the variation between sexes in Ophiophagus hannah.*

Character	N*	Male mean	Range	N*	Female mean	Range
Ventrals	8	250.8	246–257	3	262.7	258–266
Subcaudals	7	101.4	90–116	3	101.0	98–104
Tail length/standard length	6	0.280	0.259–0.312	3	0.247	0.242–0.249

* Includes several records from Taylor [(1922a) 258].

Sexual dimorphism.—I have combined my data with those given by Taylor [(1922a) 258] excluding the counts and measurement for EHT 13 which, because of its high ventral count and low tail length/standard length ratio, I believe it was incorrectly sexed. Differences between males and females are not striking (Table 1). Males average fewer ventrals than females. They do not differ in subcaudal counts, however. This is of interest because in comparing two individuals of approximately the same standard lengths (♂, 1,610 mm; ♀, 1,590 mm) the male was found to have a considerably longer tail. This was not an isolated case. The tail length/standard length ratio for males is higher than for females.

Ecological notes.—As I have already noted above, much has been written about this remarkable snake. I am unable to add

any new or pertinent information and therefore refer the reader to one or more of the numerous accounts which have already appeared in print. The most comprehensive discussion of this snake was prepared by Wall [(1924) 189–195] who discussed breeding, nesting and brooding habits, food requirements, size, and other factors for which the king cobra has acquired its reputation. Evans (1903) described several situations in which the king cobra was encountered by travelers, and Mell [(1929) 228] and Smith [(1943) 438] add observations of their own.

Little has been written about this snake in the Philippines. The localities at which the snake has been collected suggest that it can exist in a variety of climatic situations. It has been taken at sea level and at altitudes in excess of 5,000 feet (at Baguio, Luzon).

Nothing is known of the time of breeding in the Philippines, of their favorite haunts, the food habits, or the influence on the human population. Taylor [(1922a) 256] makes a general statement that these snakes are deadly poisonous to man, a fact that elsewhere is borne out by a multitude of statistical data. Regretfullly, there is a dearth of data regarding the incidence of cobra bits in the Philippines [Reyes and Lamanna (1955)].

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