

A CODING SYSTEM FOR MARKING *GYMNOPHOLUS* WEEVILS IN NEW GUINEA¹

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Abstract: A coding system is described and tabulated which permits individual recognition for up to 39,999 marked field-released weevils. For increased reliability, the system comprises 2 independent codes, each one of which translates to the same assigned number of the weevil. Coding is based on color-type and mark-position giving values from 1 to 9 in different numerical sets representing units, tens, hundreds, etc. Sum of values from each set gives the individual's number in each of the two codes. Three colors are used in marking. Materials, methods and early results of recoveries are discussed.

In order to facilitate ecological field observations of *Gymnopholus* weevils, it was evident that a coded marking system should be devised enabling the observer to quickly recognize every marked individual encountered without having to resort to keys or complicated charts. Continued surveillance of marked *Gymnopholus* weevils should contribute information relating to their longevity, movements, and relationships with the plant and animal symbionts they carry on their backs. These large weevils are well-suited for this type of study as they are flightless and populations of some species, especially those of *G. (Symbiopholus)*, tend to remain confined to clearings on mountain tops thereby making conditions ideal for recovering released individuals. The system described herein should enable the trained observer to quickly identify a marked individual in the field, often without having to disturb it.

The system being tested employs 2 separate codes of enamel markings on each individual. Each code is independent of the other, and each has usable mark-combinations translatable to any number to 39,999. Every weevil to be released is assigned an accession number, then marks are applied so as to translate to the same number by each of the two codes. The use of two codes is a precaution in case a mark should wear off, or should a marked part become damaged or lost. Adding to reliability, each code is placed on different regions of the weevil.

Members of *Gymnopholus* s. str. and *G. (Symbiopholus)* are treated separately, with individuals of each subgenus having their own consecutive numbers.

Coding. Each code is based on color-type and mark-position giving values from 1 to 9 in different numerical sets representing units, tens, hundreds and thousands. In decoding, each set is translated to its value, then all sets are added giving the number of the individual in each of the 2 codes. Every numerical set has 3 positions for use with 1 of 3 colors. In a set, both the position and color determine the numerical value; that

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2. Bishop Museum, Honolulu, Hawaii.

		RED or WHITE*			ORANGE			YELLOW		
		1	2	3	4	5	6	7	8	9
1	LEFT side: Series 1 Series 2	pT	mT	mtT	pT	mT	mtT	pT	mT	mtT
		S	PN	EL	S	PN	EL	S	PN	EL
10	RIGHT side: Series 1 Series 2	pT	mT	mtT	pT	mT	mtT	pT	mT	mtT
		S	PN	EL	S	PN	EL	S	PN	EL
100	LEFT side: Series 1 Series 2	pF	mF	mtF	pF	mF	mtF	pF	mF	mtF
		PNapx	ELbase	ELapx	PNapx	ELbase	ELapx	PNapx	ELbase	ELapx
1000	RIGHT side: Series 1 Series 2	pF	mF	mtF	pF	mF	mtF	pF	mF	mtF
		PNbase	ELbase	ELapx	PNbase	ELbase	ELapx	PNbase	ELbase	ELapx
10000	— Series 1 Series 2	red or white band on snout								
		red or white spot on basal abdominal sternum								
20000	— Series 1 Series 2	orange band on snout								
		orange spot on basal abdominal sternum								
30000	— Series 1 Series 2	yellow band on snout								
		yellow spot on basal abdominal sternum								

Table. Coding system scheme. Key: pT=protibia, mT=mesotibia, mtT=metatibia, pF=profemur, mF=mesofemur, mtF=metafemur, S=antennal scape, PN=side of pronotum, EL=side of elytron, PNapx=apex of pronotum (mark placed medially), ELbase=base of elytron, ELapx=apex of elytron, PNbase=base of pronotum (mark placed medially).

* White replaces red on some recently marked weevils.

is, 3 positions \times 3 colors=9 combinations giving an array of values from 1 to 9 depending on the combination. The mark is used at only one place in its set, thus simplifying both the initial marking and the ensuing interpretations. Colors indicate the following values: red or white=1, 2, or 3; orange=4, 5, or 6; yellow=7, 8, or 9. The position of the color determines 1 of its 3 possible values.

For convenience I have called the initial code "Series 1"; it is a little easier to follow than the second code, "Series 2", although the same concept applies to both. Mark locations of the 3 positions for Series 1 are as follows: **units**=*left* pro-, meso-, and metatibia; **tens**=*right* pro-, meso-, and metatibia; **hundreds**=*left* pro-, meso-, and metafemur; **thousands**=*right* pro-, meso-, and metafemur. For Series 2: **units**=*left* antennal scape, *left* pronotal side, *left* elytral side; **tens**=*right* antennal scape, *right* pronotal side, *right* elytral side; **hundreds**=pronotal apex, *left* elytral base, *left* elytral apex; **thousands**=pronotal base, *right* elytral base, *right* elytral apex. Coding for higher values is not yet in use; the following arrangement is tentative. Series 1=band on snout, Series 2=spot on basal abdominal sternum, with colors indicating: red or white=10,000, orange =20,000 and yellow=30,000. Note: white replaces red on some recently marked weevils. See Table.

Example: a weevil assigned the number 9533 would be marked as follows: for Series 1—yellow on right metafemur (9000)+orange on left mesofemur (500) + red or white on right metatibia (30) + red or white on left metatibia (3)=9533; for Series 2—yellow on right elytral apex (9000) + orange on left elytral base (500)+red or white on right elytral side (30) + red or white on left elytral side (3)=9533.

Materials. Marking is conducted over a portable tray comprising a 45 \times 60 cm piece of plywood with holders for three brushes and paint bottles. A small block of wood is glued near the front of the tray and serves as a restrainer for the weevil and a 15 cm celluloid rule when body measurements are taken. A separate weevil holding device resembling a small ringstand (base 10 \times 17 cm; post 10 cm) can be placed at any convenient position on the tray. The post holds a modified utility clamp normally used for laboratory apparatus. After cutting off the tips, each of the grasping ends of the clamp is about 6 mm in height and is slightly convex in cross-section. Several 20 \times 20 \times 20 cm mosquito-type sleeve cages are used to hold the weevils, and several small plastic containers with lids are used to isolate the weevils while paint is drying. Three brushes used are Delta 000, style 527 red sable, watercolor-type. Paints and polish so far tested are:

Testor's Pla Decorative Enamel: No. 4 red, No. 1145 white, No. 27 orange, and No. 14 yellow. (The Testor Corp., Rockford, Illinois)

Labink, For Marking Glass or Porcelain: No. 6249 red. (Arthur H. Thomas Co., Philadelphia, Pennsylvania)

Cutex Colourless [fingernail] Polish. (Chesebrough-Ponds International Ltd., Melbourne, Australia)

Methods. The weevil is assigned a number, then missing parts or other injuries, identity of sex and body length are recorded in a journal before it is painted. Additional observations of plant and animal symbionts are made in specimens of *G. (Symbiopholus)* under a dissecting microscope at about 30 \times before painting. Notations are made on sizes and positions of lichen and liverwort growths, and on visible numbers of nymphal and adult *Symbioribates* mites and rotifers. When body length measurements are made,

the weevil is pressed to the surface of the celluloid mm rule and held in a linear position along the rule with the snout and rule held firmly against the restraining block, then the reading is taken at the elytral apices. Length is recorded to about the nearest one-half mm; should the apex of the weevil clearly exceed the last whole mm, a plus sign is merely recorded with the measurement. Before painting, the coding is determined for the number assigned, then the weevil is either hand-held or placed in the tension clamp for marking. In painting cylindrical parts (e. g., tibiae, femora), most of that part is covered and is fully encircled with paint; for more or less flat surfaces (e. g. parts of pronotum, elytra), a spot about 4 mm in diameter is applied. Each freshly painted weevil is isolated in a plastic container until the marks are dry, next it is examined for rubbed marks or excess paint, corrections are made if necessary, then all marks are coated with clear fingernail polish, and finally the weevil is placed in a holding cage to await release.

Results. 588 weevils have been marked, documented and released in the Wau-Mt Kaindi area from December 1966 through May 1967. Numbers of released individuals of the various spp. are listed as follows:

<i>Gymnopholus (Gymnopholus)</i> 1-485		
	<i>interpres</i> Hllr.	2
	<i>marquardtii</i> Hllr.	17
	<i>weiskei</i> Hllr.	466
<i>Gymnopholus (Symbiopholus)</i> 1-103		
	<i>lichenifer</i> Gr.	103

Time represented in marking and documenting the above is roughly 52 hours. Maximum time per processing each individual of *Gymnopholus* s. str. is about 4 minutes; for each *G. (Symbiopholus)* it is about 12 minutes. The considerably slower rate for the latter accounts for time used in making and recording observations of symbionts.

Wear of paint. Enamel: various degrees of wear of marks were evident 60-120 days after initial release. Because of the excellent color-brilliance of intact 120 day old marks, I decided to continue using enamel, but in combination with a clear, protective coating of fingernail polish. Not enough time has elapsed to appraise the wear of the coated enamel marks, but weevils marked by Dr J. L. Gressitt with random patterns of fingernail polish have been recovered after 12 months of initial release, and all polish marks noted were in very good condition.* Porcelain paint: excessive wear of marks (red only) was noted on all recoveries 30-60 days following release; this paint has not been tried with the clear polish coating.

Other types of marks. White thread on snouts and tibiae of some weevils released by J. L. Gressitt have been recovered 7-12 months after initial release, and threads showed little indication of wear. Application of colored threads (corresponding with Code Series 1) with protective coating of polish is being planned. Wire: several colors of fine, radio coil wire (corresponding with Code Series 1) have been attached to tibiae of about 20 weevils, but application of the wire was difficult and time-consuming, and not judged as very practical.

* Recoveries of marked specimens have now been made after 3 years of initial release — See Gressitt & Sedlacek, this issue.