Experimental Hybridization of an Insular Form of *Tropisternus collaris* (Fabricus) with Mainland Subspecies (Coleoptera: Hydrophilidae)[1]

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Matings between the three North American subspecies of beetles in the *Tropisternus collaris* complex and a melanic form from Colombia show varying degrees of fertility and viability depending upon which two subspecies are mated in a given cross (Table 3). Each of the subspecies studied has a distinctive head, pronotal, and elytral pattern, and there is a definite relation between the dominance of one pattern over another and the degree of pigmentation. The purpose of the present study was to determine the relation of color pattern and fertility between an insular subspecies found in Puerto Rico and the four mainland subspecies.

Materials and Methods

The insular strain of *Tropisternus collaris* (Fabricus) was collected in April, 1966, near Camuey, Puerto Rico (CAM). The beetles were found in a quiet backwater, thirty yards in diameter, of a slow moving stream. The water was about one foot deep with a layer of mud at least nine inches thick on the bottom. Emergent grasses, with stems three to six inches apart, occurred along the edges and out several feet from shore. The only shade was that of these plants and the bank. *Tropisternus lateralis* (Fabr.) was common along with other aquatic beetles, but *T. collaris* was relatively rare. Only six specimens were caught in thirty minutes of collecting. These were transported to Bloomington, Indiana, in jars containing moist, sterile sphagnum. The mainland subspecies used in the crosses were stock cultures of *Tropisternus collaris mexicanus* (Castelnau), *T. c. viridis* (Young and Spangler), and *T. c.* cf. *parananus* (Sharp) whose parents were from Walamo, Mexico (WAL), Bivin's Arm of Payne Prairie, near Gainsville, Florida (BIV), and Lago de Ayapel, Colombia (AYA), respectively. CAM males were mated with BIV, AYA, and WAL females, and a single CAM female was mated with a WAL male and subsequently with a CAM male. The F_1 progeny were selfed and were backcrossed to the subspecies which had the recessive color pattern. The beetles were fed, handled, and cared for in a manner similar to that reported in Young (1). For those larvae which had failed to burrow into the sand after one week of exposure to it, narrow holes were poked in the sand to form a chamber one-quarter inch in diameter. One larva was placed in each hole, and the chamber was closed with a glass coverslip. The sand was kept moist enough to give it a darker color than when dry, and dry enough so that water did not collect at the

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bottom of the container. After two weeks in the sand, all the beetles which had not emerged were dug up, and those which were not adults were placed in a sand chamber as mentioned above.

Results

The results of the crosses are summarized and included in tables 1, 2, and 3. If the number of eggs in a given eggcase was not known, the eggcase and larvae emerging from it were not included in the data unless there were no other data from the cross. Crosses which did not produce any eggcases were not included in the results.

TABLE 1. Color Pattern Dominance and Segregation in Crosses Between Different Forms of **Tropisternus collaris**

Cross	Color Pattern	
	F_1 Progeny	F_1 x F_1 and Backcross Progeny
CAM x CAM	CAM	CAM
CAM x WAL	WAL	WAL, CAM, and some intermediate patterns
WAL x CAM	WAL	WAL, CAM and some intermediate patterns
BIV x CAM	CAM	CAM, BIV and some intermediate patterns
AYA x CAM	CAM	CAM, AYA and some intermediate patterns

See Table 2 for explanation of abbreviations.

Discussion and Conclusion

For all the pureline times pureline hybrid crosses, the F_1 progeny show the same general color pattern as the lighter parent (Table 1). When the F_1 progeny are selfed or backcrossed to the darker parent, the resulting progeny show much greater pattern variability than either of the parental subspecies. Many of these progeny have intermediate patterns which indicate that more than one gene controls color. These results are consistent with those obtained when the mainland subspecies are intercrossed (2, 3). Studies are now in progress to determine the number and action of the genes controlling the color pattern elements.

The results of the crosses in Table 3 show experimentally that *Tropisternus collaris* (Fabricius) from Puerto Rico is indeed part of this species complex. In almost all cases, the hybridization resulted in heterosis, even in those crosses where the F_1 progeny were infertile. The low fertility of the *AYA* x *WAL* and *WAL* x *AYA* crosses is most probably due to the old age of the parents. In all crosses between *AYA* and *CAM* and their progeny, the fertility and viability was greater than or equal to that of the parent subspecies. High fertility and viability occurs when *BIV* and *WHR* are crossed and F_1 progeny are selfcrossed and outcrossed to *AYA*. When *WAL* is crossed with any of the other subspecies studied, the F_1 progeny are fairly sterile when selfcrossed. Thus, the five subspecies of the *Tropisternus collaris* species-complex appear now to be divisible into at least three breeding

TABLE 2. Crosses of Wild Individuals of Forms from the **Tropisternus collaris** Complex and their Offspring.

	Wild x Wild									F_1 x F_1								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
WHR x WHR	4	5	5	123	123	100%	89	51	57%	2	5	5	127	81	64%	81	24	29.0%
BIV x BIV	3	5	5	104	99	95%	72	36	50%	0								
WAL x WAL	3	10	10	312	213	68%	109	73	66%	0								
CAM x CAM	1	5	5	85	85	100%	85	52	61%	3	10	10	166	166	100%	35	19	54.3%
AYA x AYA	1	2	2	43	43	100%	43	30	70%	3	14	13	451	378	84%	336	42	12.5%
	F_2 x F_2									F_3 x F_3								
AYA x AYA	3	22	22	494	494	100%	494	240	48%	3	10	10	232	232	100%	31	17	55.0%

Abbreviations are as follows: WHR—*Tropisternus collaris striolatus* (LeConte) from White River at Elnora, Indiana (1963 and 1964)
BIV—*viridis* (Young and Spangler) form from Bivin's Arm of Payne Prairie, near Gainesville, Florida (1964)
WAL—light form of *mexicanus* (Castelnau)from Walamo, Sinaola, Mexico (1965)
CAM—light form of *T. collaris* from Camuey, Puerto Rico (1966)
AYA—melanic form of *T. collaris* from Lago de Ayapel, Colombia

Figures at head of columns indicate:
1 Number of matings
2 Total number of eggcases from all matings
3 Number of eggcases from which larvae hatched
4 Total number of eggs in all eggcases
5 Total number of living larvae hatching
6 Per cent larvae hatching Column 5/Column 4
7 Total number of larvae reared
8 Total number of adults reared
9 Per cent adults reared Column 8/Column 7

TABLE 3. Hybridization of Wild Individuals of Forms from the **Tropisternus collaris** Complex and Their Offspring

	Hybridization									F^1 x F^1									Backcross								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
AYAxCAM	4	15	11	262	262	100%	214	178	70%	20	74	56	1134	1080	95%	76	40	58%	10	22	18	510	502	98%	445	201	45%
BIVxCAM	3	9	6	67	66	99%	54	45	83%	9	21	6	297	28	9.5%	0			4	9	7	108	63	58%	23	10	44%
WALxCAM	2	2	2	44	44	100%	28	20	72%	4	4	0	35	0	%	0			6	35	4	593	9	1.5%	9	3	33%
CAMxWAL	1	1	1	21	21	100%	21	10	48%	0									9	40	2	443	10	2.3%	10	3	30%
BIVxWHR	2	17	13	336	336	100%	126	85	68%	3	11	11	226	226	100%	168	76	45%	0								
WHRxBIV	1	1	1	33	33	100%	33	19	58%	0									0								
WALxWHR	2	11	10	203	180	89%	83	48	58%	4	23	14	327	135	41%	85	52	61%	1	1	1	30	30	100%	16	8	50%
WHRxWAL	2	9	7	183	147	80%	78	55	71%	5	24	0	420	0	0%	0			0								
WALxBIV	2	15	11	300	246	82%	246	100	41%	3	13	3	233	13	6%	13	0	0%	3	22	15	500	401	80%	223	116	52%
AYAxWAL	5	41	26	849	434	51%	434	162	37%	11	29	3	524	13	3%	13	4	30%	8	27	6	491	27	6%	27	2	7%
WALxAYA	1	7	6	125	20	16%	20	15	75%	3	17	6	341	10	3%	10	1	10%	5	23	12	380	54	14%	45	25	55%
AYAxBIV	2	10	7	156	152	97%	152	80	53%	16	35	0	1400	0	0%	0			3	32	17	*	141	*	141	92	65%
AYAxWHR	3	8	5	*	95	*	52	25	49%	15	66	0	*	0	0%	0			21	133	43	1534	114	8%	114	21	19%
WHRxAYA	2	9	9	*	312	*	312	145	46%	3	20	0	*	0	0%	0			6	57	26	*	101	*	101	45	45%

See Table 2 for explanation of abbreviations and column headings.

populations, South American (including Puerto Rico), North American, and West Mexican, which may be isolated from the rest of the North American population by the Sierre Madre Occidental Mountains. The hybridization of the *mexicanus*-like form found in southwestern United States and eastern Mexico with *WAL* and *WHR* to determine if *WAL* is truly an isolated breeding population have not been made.

I wish to thank Dr. F. N. Young for the use of his unpublished data included in Tables 2 and 3.

Summary

The five subspecies of *Tropisternus collaris* (Fabricius) studied appear now to be divisible into three breeding populations. *Tropisternus collaris* from Puerto Rico, which belongs to the South American breeding population, exhibits color pattern dominance relations similar to those exhibited by the other four subspecies.

References Cited

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