Scarabaeus

A NEWSLETTER FOR THOSE INTERESTED IN SCARABAEIDAE

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OBSERVING DUNG BEETLE NESTING BEHAVIOR

In an earlier newsletter (No. 2, June 1980) I described the several nesting patterns known or assumed for U. S. species of Scarabaeinae. Since this article was couched in very general terms, one might have easily presumed that the nesting behaviors of a large number , if not the majority of U. S. species had already been carefully scrutinized. This is certainly not the case. In fact, the behavior of only a small number of species has been observed to any degree at all; even fewer have received careful attention. Thus, there is a great deal yet to be discovered about the way most dung beetles nest.

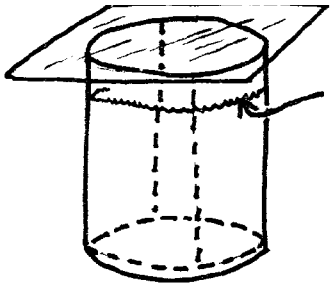
The purposes of this article are several. First, and foremost, I hope that it stimulates interest in rearing native species and observing their behavior. Most species studied so far have proven to be remarkably unperturbable and highly adaptable to laboratory conditions; dung beetles are easy to raise. Second, I want to offer some pointers on how to go about raising these beetles. And, third, I want to suggest the kinds of observations which are most likely to produce useful data; that is, suggest a "starter list" of things to look for.

FACILITIES FOR RAISING DUNG BEETLES

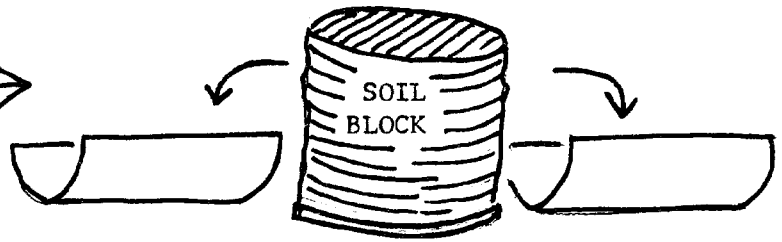
A facility for raising dung beetles has four major components: a) an enclosure which provides a suitable place for nesting; b) soil which is qualitatively and quantitatively adequate for nesting; c) a reasonable climatic ambient; and d) an appropriate food supply.

The Enclosure --- Almost any enclosure will suffice that meets the following criteria: it is escape-proof, can be opened easily so that soil can be examined methodically, and is of adequate size. Boxes, cans, specially constructed terraria, plastic buckets and the like are fine. But they must be constructed or modified so they can be opened without disturbing the soil they contain. No enclosure should be used which requires that the soil be dumped out or which requires a sharp force to open (such as that needed to break open a bottle or flower pot). The idea is, after an appropriate amount of time, to expose a "block" of soil which will be subjected to slow, systematic examination.

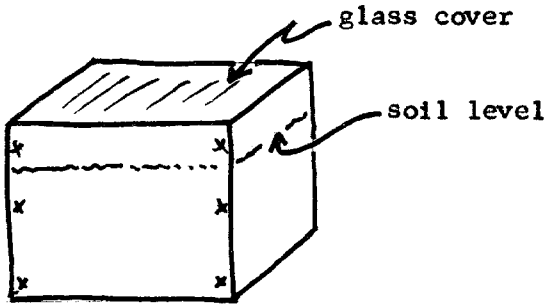
An appropriate shape and size for the nesting container will depend upon whether the species to be raised is a ball-roller or a burrower. Rollers require a large surface area but not much soil depth since they ordinarily bury their brood balls shallowly. For a burrower, soil depth is more important than surface area. While shape is influenced by habits, the absolute size of the nesting container will depend upon



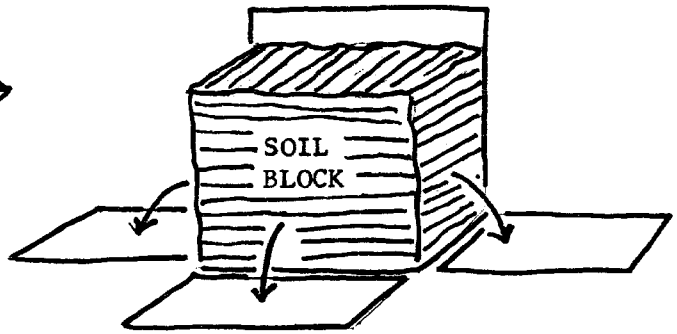
Cylindrical container, pre-cut around bottom and down each side and closed with duct tape.

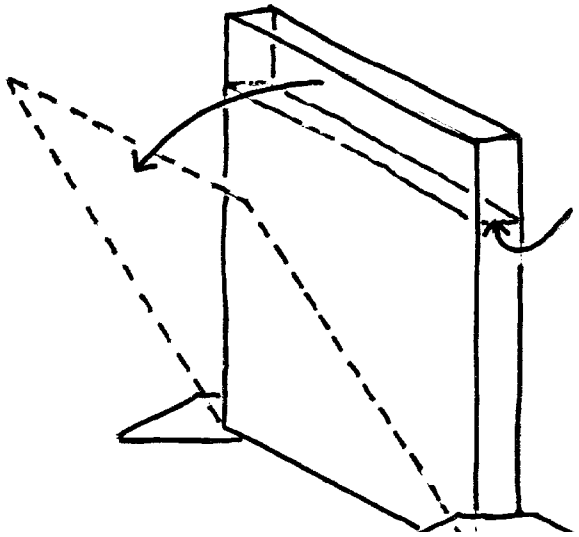


Sides removed to expose soil block containing nests



Box constructed so that 3 sides can be removed





Vertical terrarium (of plexiglass) with removable side panel. (Not suitable for ball rollers.)

EXAMPLES OF CONTAINERS WHICH COULD BE USED TO RAISE DUNG BEETLES AND OBSERVE NESTING BEHAVIOR

beetle size. A reasonable rule-of-thumb for raising burrowers is to provide soil to a depth of at least 20 times the body length of the beetle; any less may result in distortion of nest architecture. For ball-rollers, a soil depth of 10 cm should be adequate for medium-sized species (± 15 mm body length); proportionately less (or more) for other species.

The best cover for the enclosure is a sheet of glass. Glass allows easy observation of surface activities, prevents drying of food and soil, and decreases objectionable odors.

Soil --- Soil choice is important since many dung beetles will nest only in the "right" kind. The best procedure is to use soil from the site where the beetles were collected. If "native" soil cannot be used, a sandy loam with some clay content is usually a good substitute. Soil used should be moist but not wet (unless the "native" soil was clearly otherwise), firmly packed, and freed of large inclusions (rocks, etc.) which could interfere with observations later on.

Ambient --- Nesting containers should be protected from climatic extremes since they do not afford the degree of protection beetles find underground. Preferably, they should be set up undoors, and away from direct sunlight. If they are maintained out-of-doors, again direct sunlight and sites subject to large temperature fluctuations must be avoided.

Food --- As far as is known, adult dung beetles almost always provide larvae with the same kind of food they eat, and the nest container should be supplied accordingly. Unused food should be replaced every few days, before it becomes dried out or highly deteriorated. If "natural" food is not available, human excrement is acceptable to (or even preferred by) most dung feeders; ground meat to carrion feeders. Species feeding on horse dung and on rodent pellets or other "unusual" sources should, if at all possible, be supplied their natural diet as they tend to be more sensitive to food switching than other species.

Most dung beetles in the U. S. are active during the warmer, moister seasons. Many (most?) are not sexually active immediately upon emergence from the soil; rather, they pass a sometimes lengthy period of maturation before nesting behavior commences. Thus, they should not necessarily be expected to begin nesting right away if new adults have been placed in the rearing chamber. Patience and some experience will (most of the time!) lead to productive results if the basic needs of the beetles have been supplied.

Observations

Various aspects of the nesting process and structure of the completed nest have proven useful for comparisons among nesting behaviors. Following is a list of some important variables which deserve observation in addition to anything else that captures the attention.

a. Whether or not larval provision is supplied as a brood mass or a brood ball;

b. If a brood ball is made, whether or not it receives an outer covering of soil;

c. The position of the egg chamber and whether or not the egg lies loosely in it or is cemented to the floor;

d. Whether or not the food provided larvae has been freed of large inclusions (e.g., grass stems, seeds, etc. in cowdung);

e. The architecture of the completed nest (disposition of brood masses/balls, course of tunnels, dimensions, etc.);

f. Whether the completed nest is simple (contains but a single brood mass or ball) or compond (more than one);

g. Whether or not the male participates in any phase of the mesting procedure (i.e., is there male-female cooperation?);

h. Whether the female remains in the nest care for her brood or abansons the completed nest.

These are obviously not the only aspects of nesting which could or even should be observed. Most of them relate to the completed nest and not to details of the construction process, about which very little has been observed directly. Besides nesting, laboratory observation often permits the study of related sexual activity, such as copulatory behavior and combat; it always results in the opportunity to collect immature stages, very few of which have been adequately described.

Observation of the soil block in a rearing container (see illustration) is best done very slowly. A knife or blade scraper is used to "shave" off successive, thin vertical layers of soil to expose nest tunneling, brood masses, etc., with minimum disturbance to surrounding areas. Such an approach allows precise "mapping", measuring and photographing (or drawing) of nest contents.

Following is a list (not guaranteed to be complete) of U. S. species whose nesting behavior has been observed to some extent:

Onthophagus alluvius Howden and Cartwright
O. browni Howden and Cartwright
O. coproides LeConte
O. hecate (Panzer)
O. landolti texanus Schaeffer
O. medorensis Brown
O. oklahomensis Brown
O. pennsylvanicus Harold
O. striatulus (Palisot de Beauvois)
O. tuberculifrons Harold
*Dichotomius carolinus (L.)
Ateuchus histeroides (Weber)
*Phanaeus vindex MacLeay
*P. difformis LeConte
*P. igneus Olsoufieff
*P. quadridens (Say)
*P. triangularis (Say)
*Copris remotus LeConte
C. fricator (Fab.)
*Canthon pilularis (L.)
*Deltochilum gibbosum

Only those asterisked species have received enough attention to answer most of the basic questions about nesting behavior suggested above. About most of the others on the list we really know very little, and the information we do have about them is questionable in some cases. The truth is that observation of the behavior of most species on the above list in addition to those about which we know virtually nothing would doubtless produce worthwhile results. - W. D. E.

Subfamily SCARABAEINAE
  Tribe SCARABAEINI — Keys: Halffter 1961:229; Halffter & Martinez 1977:32,42

Melanocanthon Halffter 1958:210 — Keys: Robinson 1941:127; Robinson 1947:84; Woodruff 1973:44; Halftter 1958:211

punctaticollis (Schaffer) 1915:50. (Canthon)	Fla.
nigricornis (Say) 1827:207 (Ateuchus)	Mass.-Tex. Kan. Ga.
granulifer (Schmidt) 1920:126 (Canthon)	Fla.-Tex.
bispinatus (Robinson) 1941:128 (Canthon)	R.I.-Fla.

Canthon Hoffmannsegg 1817:38 — Keys: Halffter 1961:259; Robinson 1947:84

Coprobius Latreille 1829:535
Hyboma Laporte 1840:74
Coeloscelis Reiche 1841:213

Subgenus Canthon, sen. str.	
chalcites (Haldeman) 1843:304 (Coprobius)	Mass.-Neb.-Fla.-Tex.
cyanellus LeConte 1859:11	Tex.-Mex.
cyanellus LeConte.	
spinosus Harold 1863:174	
speciosus Harold 1868:41	
humectus (Say) 1832:4	
hidalgoensis Bates 1887:32	Tex.-Mex.
imitator Brown 1946:104	Okla.-Tex.-Ariz.
floridanus Brown 1946:105	
indigaceus LeConte 1866:380	Ariz.
indigaceus LeConte	
pilularius (Linnaeus) 1758:349 (Scarabaeus)	Mass.-Mont.-Tex.
laevis (Drury) 1770:79 (Scarabaeus)	
hudsonius (Forster) 1771:24 (Scarabaeus)	
volvens (Fabricius) 1792:66 (Scarabaeus)	
obtusidens (Ziegler) 1844:45 (Coprobius)	
viridescens Horn 1870:47	
vigilans LeConte 1858:16	Mass.-Kan.-Tex.
Subgenus Boreocanthon Halffter 1958:208	Key: Halffter 1958:209
depressipennis LeConte 1859:11	Ga.-Fla.-Tex.-N.Dak.
ebenus (Say) 1823:208 (Ateuchus)	Mex.-Tex.-Kan.-Ariz.
integricollis Schaeffer 1915:50	Tex.-Ariz.
lecontei Harold 1868:68	Tex.-N.Mex.
melanus Robinson 1947:88	Ariz.-Mex.
mixtus Robinson 1947:91	Tex.
praticola LeConte 1859:10	Kans.-Neb.-Ariz.
probus (Germar) 1824:98	N.J.-Fla.-Ariz.-Ut.
minor Sturm 1843:104	
abrasus LeConte 1859:10	
puncticollis LeConte 1866:381	N.Mex.-Ariz.-Baja-Mex.
simplex LeConte 1857:41	B.C.-Cal.-Ariz.-Colo.
corvinus Harold 1868:129	Baja.-Mex.
militaris Horn 1870:46	
humeralis Horn 1870:46	
bisignatus Balthasar 1939:229	

Subgenus Glaphyrocanthon Martinez 1948:41
viridis (Palisot de Beauvois) 1805:24 — N.Y.-Wisc.-Tex.-Mex.
viridis (P. de Baeuv.)
obsoletus (Say) 1823:208 (Ateuchus)
viridicatus (Say) 1835:173 (Onthophagus)
metallicus Sturm 1843:104
Pseudocanthon Bates 1887:35
perplexus (LeConte) 1847:85 (Canthon) — N.C.-Ill.-Ariz.-Mex.

Deltochilum Escholtz 1822:37 — Key: Howden 1966:733
gibbosum (Fabricius) 1775:28 (Scarabaeus) — N.C.-Kent.-Tex.
gibbosum (Fabr.)
scabriusculum Bates 1887:38 — Tex.-C.Rica
scabriusculum Bates

Malagoniella Martinez 1961:81 — Key: Halftter & Martinez 1966:114
astyanax (Olivier) 1789:188 (Scarabaeus) — Tex.-Mex.
yucateca (Harold) 1863:173 (Megathopa)

Tribe COPRINI

Ateuchus Weber 1801:10 — Keys: Woodruff 1973:51; Robinson 1948:37

Choeridium Serville 1828:356
histeroides Weber 1801:37
histeroides Weber — N.J.-Fla.-Kans.-Tex.
capistratus Fabricius 1801:62
punctatus (Robinson) 1948:39 (Choeridium) — Mich.-Ill.-Pa.
lecontei (Harold) 1868:52 (Choeridium) — N.J.-Ala.-Fla.
texanus (Robinson) 1948:38 (Choeridium) — Tex.

Dichotomius Hope 1838:321 — Synopsis: Schaeffer 1906:256
Homocopris Burmeister 1842:77
Pinotus Erichson 1847:108
Brachycopris Haldeman 1846:125
carolinus (Linnaeus) 1767:125 (Copris) — Mass.-S.D.-Tex.-Fla.
bituberculatus (Harold) 1869:127 (Pinotus)
colonicus (Say) 1835:174 (Copris) — Ariz.-Tex.-Mex.

Copris Muller 1764:11 — Keys: Matthews 1961:35
arizonensis Schaeffer 1906:254 — Ariz.-Tex.-Mex.
fricator (Fabricius) 1787:140 (Scarabaeus)
fricatur (Fabricius) — Maine-Ont.-S.D.-Tex.-N.C.
tullius (Olivier) 1789:3 (Scarabaeus)
anaglypticus Say 1823:204
cartwrighti Robinson 1941:131 — S.C.
gopheri Hubbard 1894:305 — Fla.
howdeni Matthews and Halftter 1959:200 — Fla.
inemarginatus Blatchley 1918:54 — Fla.
lecontei Matthews 1961:98
lecontei Matthews — Ariz.-N.M.-Mex.
minutis (Drury) 1770:78 (Scarabaeus) — N.Y.-Iowa-Tex.-Fla.
silenus (Fabricius) 1775:21 (Scarabaeus)
ammon (Fabricius) 1781:24 (Scarabaeus)
lar (Fabricius) 1801:35 (Scarabaeus)
reflexus Panzer 1794:7
remotus LeConte 1866:381
remotus Le Conte — Okla.-Tex.-Mex.

Coprophanaeus d'Olsoufieff 1924:22	Key:	d'Olsoufieff 1924:23
pluto (Harold) 1863:164 (Phanaeus)		Ariz.-Mex.
Phanaeus MacLeay 1819:124	Keys:	d'Olsoufieff 1924:22
Lonchophorus Germar 1824:126		Robinson 1948:299
Onthurgus Gistel 1857:602		
amythaon Harold 1875:88		Tex.-Mex.
difformis LeConte 1847:86		Kans.-Tex.-N.M.
igneus MacLeay 1819:133		
igneus MacLeay		N.C.-La.-Fla.
floridanus d'Olsoufieff 1924:94		Fla.
quadridens (Say) 1837:176 (Copris)		Ariz.-Mex.
laevipennis Sturm 1843:2		
triangularis (Say) 1823:206		S.C.-Mo.-Tex.
niger d'Olsoufieff 1924:95		
torrens LeConte 1847:85		
vindex MacLeay 1819:133		Mass.-S.D.-Tex.-Fla.
cyanellus Robinson 1938:107		
magnificens Robinson 1948:302		
rubervirens Robinson 1948:301		
carnifex (L) 1767, not 1758		

Tribe ONTHOPHAGINI

Onthophagus Latreille 1802:141	Key:	Howden & Cartwright 1963:10
aciculatus Blatchley 1928:128		Fla.
alutaceus Blatchley 1919:31		
alluvius Howden & Cartwright 1963:65		Tex.-Mex.
anthracinus Harold 1873:104		
arnetti Howden & Cartwright 1963:98		Ariz.
batesi Howden & Cartwright 1963:21		Tex.-Mex.
brevifrons Horn 1881:76		Ariz.-Kans.?-Tex.
browni Howden & Cartwright 1963:101		Ariz.-Tex.
cartwrighti Howden 1973:329		Cal.-B.Cal.
cavernicollis Howden & Cartwright 1963:32		Mo.-Tex.
cochisus Brown 1927:132		Ariz.-Mex.
concinnus Laporte 1840:87		N.J.-Tenn.-La.-Fla.
protensus Melsheimer 1845:134		
subaeneus Horn 1875:139		
coproides Horn 1881:75		Ariz.-N.M.-Neb.
coboidalis Bates 1887:79		
cynomysi Brown 1927:131		N.M.-Okla.
depressus Harold 1981:116		Ga.-Fla.
hecate (Panzer) 1794:5 (Scarabaeus)		
hecate (Panzer)		Nova Scotia-Albta.-Ariz.-
hastator (Fabricius) 1798:28 (Copris)		
latebrosus (Fabricius) 1801:34 (Copris)		
obtectus (Palisot de Beauvoir) 1805:25 (Copris)		
scabricollis Kirby 1837:126		
sayi Laporte 1840:87		
blatchleyi Brown 1929:86		S.C.-Fla.
hoepfneri Harold 1869:512		Ariz.-Mex.
arizonensis Schaeffer 1909:382		
knausi Brown 1927:130		Neb.-Ill.-Tex.
knulli Howden & Cartwright 1963:69		Ariz.-N.M.
anthracinus Harold 1873:104		
medorensis Brown 1929:204		Ark.-Kan.-Tex.-La.

mextexus Howden & Cartwright 1970:54	
monticolus Howden & Cartwright 1963:61	
nuchicornis (Linnaeus) 1758:347 (Scarabaeus)	Que.-B.C.-Ida.-N.J.
rhinoceros Melsheimer 1846:134	
xiphias ? LeConte 1863:36	
oklahomensis Brown 1927:128	Md.-Kans.-Tex.-Fla.
orpheus (Panzer) 1794:5 (Scarbaeus)	
orpheus (Panzer)	N.J.-Minn.-Tex.-Fla.
canadensis (Fabricius) 1801:34 (Copris)	Me.-Ont.-Minn.-Ga.
pseudorpheus Howden & Cartwright 1963:53	Ohio-Manit.-Ark.
pennsylvanicus Harold 1871:115	Ont.-S.D.-Colo.-Tex.-Fla.
ovatus Melsheimer 1806:4	
falcipes Harold 1871:115	
polyphemi Hubbard	
polyphemi Hubbard	S.C.-Fla.
sparsisetosus Howden & Cartwright 1963:38	Miss.-Fla.
schaefferi Howden & Cartwright 1963:88	Tex.-Mex.
striatulus (Palisot de Beauvois) 1809:92 (Scarabaeus)	
striatulus (Palisot de Beauvois)	Mass.-Minn.-Tex.-Fla.
janus (Panzer) 17984:5 (Scarabaeus)	
niger Melsheimer 1846:134	
cervicornis Kirby 1825:565	
castaneus Melsheimer 1845:134	
floridanus Blatchley 1928:128	Fla.
nigrescens Blatchley 1916:94	
subaeneus (Palisot de Beauvois) 1811:105 (Copris)	N.J.-Kans.-Tex.-Fla.
cribricollis Horn 1881:76	
subopacus Robinson 1940:142	Ariz.
subtropicus Howden & Cartwright 1963:30	Tex.
tuberculifrons Harold 1871:115	Ct.-Wisc.-Kans.-Tex.-Fla.
velutinus Horn 1875:140	Colo.-Cal.-Tex.

Tribe ONITICELLINI

Oniticellus Serville 1828:356	
californicus Horn 1882:118	Fla. (?)-Cuba-Jamaica
cubiensis Laporte 1840:92	Ore.-Cal.

Introduced Species

Onthophagus gazella (F.) 1787:377 (Scarabaeus)	Tex.-Cal.
O. taurus (Schreber) 1759:7 (Scarabaeus)	Tex.-Cal.
Euoniticellus intermedius (Reiche) 1849:337 (Ouiticellus)	Tex.-Cal.
Onitis alexis Klug 1835:32	Tex.-Cal.

We are sorry to announce the death of Pat Vaurie, on March 12, 1982, in New York.

F. T. Hovore sends the following notes:

Rutela formosa Burmeister - A long series of this rarely-collected Antillean species was collected by F. T. Hovore and R. L. Penrose in early May on upper Key Largo, Monroe County, Florida. Larval, pupal and numerous adult Rutela were broken from the decayed heartwood of logs of Bursera and Metopium, and a few adults were swept from foliage or netted in flight. Trigonopeltastes delta Forster was also breeding in the decaying logs.

Acoma brunnea Casey - Numerous males of this obscure species were swept from the tops of dried, dead Gutierrezia and other miscellaneous herbaceous plants growing in a low sandhill area along Interstate 10, 2 miles N Ft. Hancock, Hudspeth County, Texas on 15 July by F. T. Hovore. The beetles were observed at dusk, crawling up the plants to the terminus of the twigs, where they sat briefly with their antennal lamellae fanned before taking wing.

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