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Food choice and plant reserves in the Turkestan harvester termite

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Abstract. Which plants does the Turkestan harvester termite, *Anacanthotermes turkestanicus*, select when several are available, and how well do its underground food stores record that choice? This narrative review compares feeding trials in Uzbekistan with surveys of vegetation and nest contents. Across trials testing 15 plant materials in the laboratory and 25 in the field, sunflower and sweet sorghum stems were consistently well consumed. A separate survey of *Anacanthotermes* found that camelthorn represented 16.70% of stored residue mass at natural sites and 4.43% at settlement margins. These percentages describe the material recovered from chambers. Estimating selection also requires a measure of the plant material available to the foragers. Seasonal differences in chamber stocks add a further complication because collection and withdrawal can occur between visits. Recording local dry biomass, incoming loads and changes in stored mass over the same interval would allow field studies to distinguish plant choice from the effects of availability and storage time.

Keywords: Anacanthotermes turkestanicus · food preference · harvester termite · plant litter · resource selection · Uzbekistan



Figure 1. *Anacanthotermes turkestanicus* photographed in Otyrar District, Kazakhstan. The photograph illustrates the species discussed in the Uzbek feeding studies. Photo by Kudaibergen Amirekul. Original photograph · CC BY-SA 4.0.

Food choice in laboratory and field trials

A worker carrying a stem to a nest entrance has already encountered, cut and transported it. A feeding trial starts later in this sequence. Researchers can place several materials within reach and ask which ones the termites use. Khamraev and colleagues applied both laboratory and field tests to *A. turkestanicus* in Central Asia [1]. Their paired settings provide the clearest species-specific evidence in this review.

Table 1. Feeding results reported for the Turkestan termite in laboratory and field tests [1].

Plant material	Published result	What can be inferred
Sunflower stems	High consumption in both settings.	The result persisted when the test setting changed.
Sweet sorghum stems	High consumption in both settings.	A second crop residue was consistently well accepted.
Common reed (Phragmites australis)	Lowest consumption among the grasses tested.	The comparison applies to the tested grasses and conditions.
Grasses and annuals	Generally more heavily used than shrubs and trees.	Plant groups differed overall, with variation within groups.

Contact with a plant and feeding on it

A later Uzbek study examined activity around Persian rose, identified by the authors as *Hultemia persica* (figure 2), and tested responses to plant extracts [3]. A worker may approach an odour, encounter a stem under a soil covering, or carry

material away. Identifying which event was recorded matters. An attractive flower extract and a readily consumed dry stem can be useful field observations about entirely different properties of a plant.



Figure 2. Persian rose and the surrounding ground at a termite site in Uzbekistan. The source describes earthen coverings around the plant. Reproduced from figure 1 of Ganieva et al. [3]. Photographs arranged side by side under CC BY 4.0.

Scope of the evidence

The review distinguishes feeding tests identified to species [1] from surveys that report nest contents for the genus *Anacanthotermes* [2]. Work on other termites is used where it tests a proposed explanation, such as the influence of wood moisture. Results are compared within studies using their original units. The available records do not support a pooled effect size.

Plants available and plants recovered from nests

A survey in Uzbekistan recorded 72 plant species in natural desert and semi-desert termite habitats and 74 in human-modified territory [2]. These counts describe the local flora. A plant can grow beside a nest yet supply little accessible dead material at the time of foraging. Conversely, a single harvested crop may leave a large mass of stems within reach of a colony.

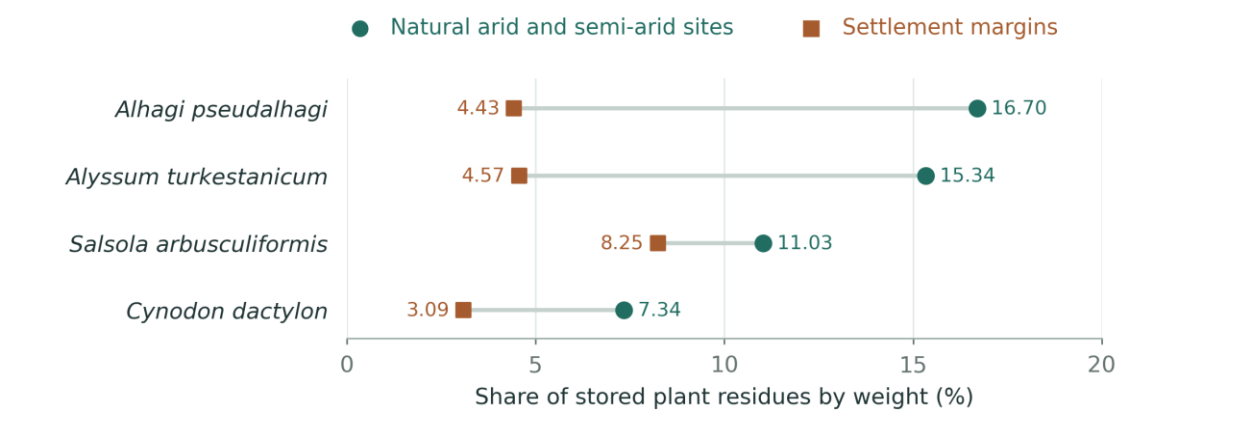

Figure 3. Four plants recorded in food chambers in both settings. Percentages are shares of residue weight within each setting. Taxon names and values follow table 3 of Ganieva et al. [2]. The four rows represent a subset of the reported flora.

Camelthorn (*Alhagi pseudalhagi*) accounted for 16.70% of stored residues by weight at natural sites and 4.43% at settlement margins, a difference of 12.27 percentage points. Three other plants also contributed a smaller share at the margins (figure 3). Crop residues entering stores at the margins could lower the percentage of camelthorn even if workers carried the same absolute mass. A comparison of absolute intake would require loads per colony over a defined interval [2, 4].

Table 2. Selected materials in the same survey illustrate differences in the local resource supply [2].

Material as identified	Sampling setting	Share of stored residue weight
Durum wheat seeds and stems	Settlement margins	6.22%
Maize stems and leaves	Settlement margins	7.30%
Black poplar fragments	Damaged buildings	34.37%
White poplar fragments	Damaged buildings	22.74%

In damaged buildings, two poplars together accounted for 57.11% of the listed residue weight. Estimating whether termites selected either wood would require an inventory of accessible timbers of each species. The proportion of poplar used in construction is therefore part of the biological question, even though it is determined by people.

What changes in food chambers can reveal

Food in an underground chamber records both the material workers have deposited and whatever is left after they remove, eat or lose part of it. Ganieva and colleagues reported stored plant pieces typically 0.3–0.7 cm long, sometimes reaching 1 cm [2]. Fragment counts and mass give different weight to thin leaves and dense stems. A chamber containing many light pieces can hold less plant matter than a chamber with a few heavy pieces.

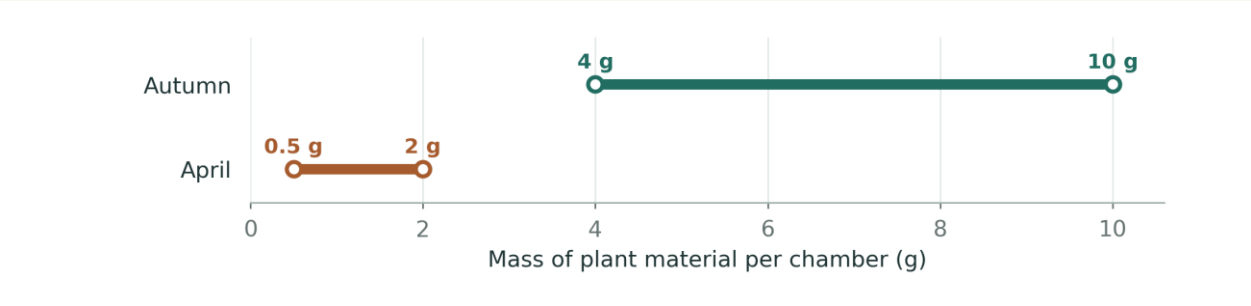

Figure 4. Reported ranges of stored plant mass per chamber in autumn and April. Endpoints show the ranges reported in the Uzbek survey [2]. They are not means or confidence intervals. The source reports food mass without specifying a dry-mass basis for these ranges.

The authors interpreted the smaller April reserves as evidence that stored material was used over winter [2]. The observations are consistent with that interpretation. Estimating a winter feeding rate would additionally require knowing how much material entered the chambers, whether workers transferred it to other chambers and whether the same stores were measured twice.

A balance for one chamber

For material measured on the same dry-mass basis, closing stock equals opening stock plus deliveries, minus withdrawals and other losses. The two hypothetical histories below give the same final mass. A stream of returning workers or repeated chamber observations would help separate them.

Table 3. Two possible histories of a single chamber. All entries are dry mass in grams. Illustrative values only.

Illustrative case	Opening stock	Delivered	Removed or lost	Closing stock
Little material arrives	8	1	6	3
Frequent deliveries	8	7	12	3

Even direct observations of workers can miss this distinction. A fragment carried through an outer entrance is a delivery to the nest, but its destination may be a different chamber. Recording the observation point and the time interval gives each measurement a physical meaning. Without those details, a net change of five grams can be mistaken for five grams eaten.

How availability changes the interpretation of choice

A storage-to-availability ratio compares the fraction of chamber dry mass contributed by a plant with that plant's fraction of locally available dry biomass. For plant i, the ratio is $w_i = s_i / a_i$, where s_i denotes its share of stored material and a_i its share of the accessible resource pool. A value of 1 denotes proportional representation. This is a descriptive application of the use-to-availability approach developed in resource-selection studies [4, 7].

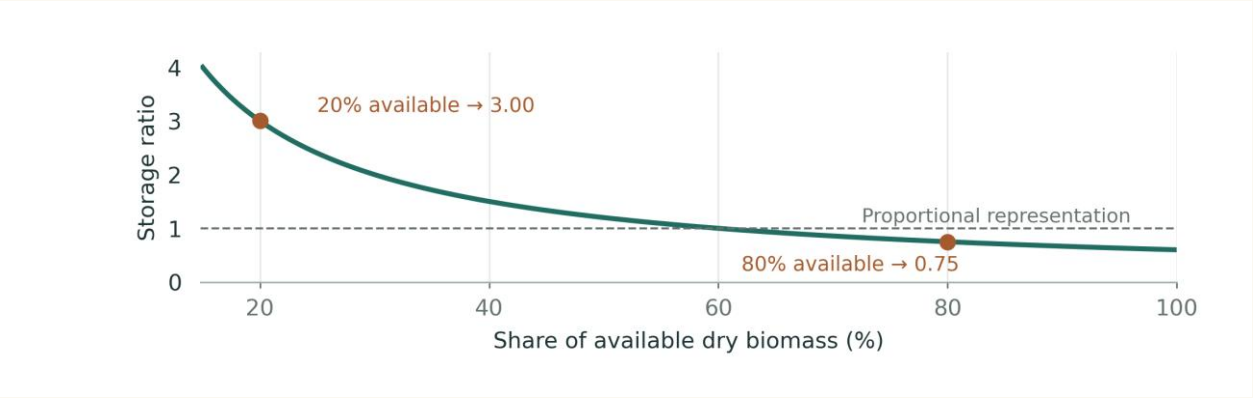

Figure 5. Worked example holding the plant's share of stored dry mass at 60%. Its storage ratio varies with the available share. The curve is calculated from w = 0.60/a, where a is the available share expressed as a proportion. No field observations are plotted.

Suppose that 60 of 100 g of identifiable stored material consists of one plant. If 80 of 100 g of accessible dry vegetation belongs to that plant, its storage ratio is 0.75. If only 20 of 100 g is available, the ratio rises to 3.00. The plant accounts for most of the chamber in both cases. Only in the second is it overrepresented relative to the measured supply.

Table 4. Matching the denominator to the ecological question [4, 7, 14].

Quantity in hand	Suitable comparison	Reason
Mass of plant fragments in a chamber	Accessible field dry mass for matching plant parts and dates.	Both quantities weight a thick stem more heavily than a small leaf.
Number of loads carried	Number of available pieces within specified size classes.	A count measures trips or pieces. Piece sizes affect the relation to mass.
Use recorded but no available material detected	Recheck the sampled area, identification and time window.	Division by zero is undefined. The result flags a sampling or timing mismatch.

A rare resource gives an unstable ratio when a small change in estimated availability produces a large change in w. Reporting both component masses lets readers judge this sensitivity. If only a small part of a nest has been examined, the result belongs to those chambers and dates. Generalising it requires other independent colonies [6, 7].

Wood condition and apparent consumption

Wood samples differ in more than their botanical identity. Moisture changes measured fresh weight and the physical properties of the wood. Fungal decay can remove dry matter before termites gain access [9, 10]. In a Khorezm study, Abdullayev and Matyakubov evaluated differences in damage to timber by *Anacanthotermes* and discussed moisture and fungi [9]. These factors matter when comparing boards recovered from buildings of different ages.

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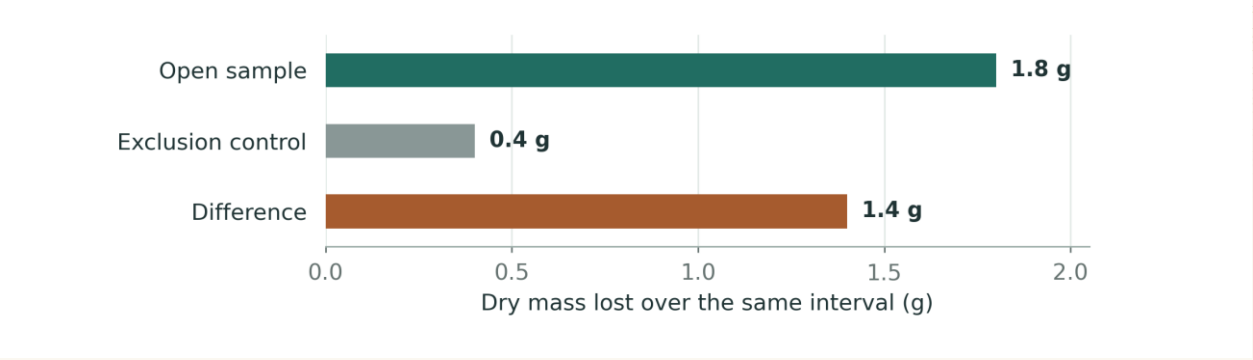

Figure 6. Hypothetical matched samples initially weighing 10.0 g dry. After exposure, the open sample weighs 8.2 g and the exclusion control 9.6 g. Subtracting control loss leaves a 1.4 g difference associated with access. The example is illustrative.

The term "associated with access" matters in figure 6. The extra loss may include pieces removed intact by workers. Mesh may also change ventilation or admit different invertebrates. A matched control is most informative when both samples experience similar moisture and temperature and when access by the target termite is independently documented.

Table 5. Comparisons that distinguish wood identity from exposure history [9–13].

Question	Comparison	Additional observation
Does wood identity affect removal?	Different species conditioned to similar moisture and size.	Record density, exposed area and initial dry mass.
Does condition alter use of one wood?	Pieces of the same species with different moisture or decay histories.	Measure moisture during exposure and describe pre-existing decay.
What does loss from a station represent?	Matched open and exclusion samples over the same interval.	Record termite visits and recover detached fragments where possible.

Experiments with the Australian termite *Coptotermes acinaciformis* show why moisture measured only at installation can mislead. Workers altered moisture at food sources, and wood properties influenced foraging choices [11, 12]. These results identify measurements worth taking in Uzbekistan. The magnitude and direction of the response in *A. turkestanicus* remain species-specific questions.

Interpreting food use across seasons and sites

A field comparison can follow each plant through three observations made at the same colony and during the same interval. First, measure accessible material of the relevant size and condition along active foraging routes. Second, identify and weigh a sample of fragments returning workers carry. Third, examine comparable chamber material. A plant overrepresented among incoming loads has passed a different test from one overrepresented only in a persistent store [1, 2, 4].

Table 6. Field records that would distinguish collection, storage and processing in a future Uzbek study.

Observation	Record for each colony and date	Question the record can answer
Field supply	Dry mass by plant taxon, part and condition in surveyed patches.	What material could workers reach during this interval?
Incoming loads	Taxon, fragment mass, observation time and number of loaded workers.	Which materials arrived, and at what observed rate?
Chamber stock	Taxon, mass and chamber identity at comparable sampling times.	Which materials accumulated or disappeared?
Evidence of feeding	Direct feeding observations and a dry-mass account of recoverable fragments.	How much apparent loss can be separated from transport?

The colony is the unit of comparison

Fifty fragments returned to one entrance describe one collection stream. They do not provide fifty independent tests of the species' preference. Nearby entrances may serve one colony. Retaining entrance identifiers and grouping repeated records by colony prevents a heavily sampled nest from dominating the result [6]. A study of the African harvester *Hodotermes mossambicus* found no marked preference for a grass species at one degraded savanna site [5]. That finding illustrates how the local resource pool and termite identity delimit a field conclusion.

Several processes remain outside a chamber survey. Gut symbionts help termites break down plant fibre [8], but the mass left in a chamber cannot measure assimilation. At a broader scale, wood discovery and decomposition vary with climate [13].

Recording season and exposure time gives comparisons of local removal rates a common basis.

Conclusion

Sunflower and sweet sorghum stems are the best-supported examples of high use by *A. turkestanicus* across the laboratory and field tests reviewed here [1]. Common reed ranked lowest among the grasses in those tests. Its performance as a building component still depends on moisture, construction and long-term exposure [10]. For regional diet studies, the most informative addition to a nest inventory would be a contemporaneous measure of accessible biomass and incoming loads. Together, these observations would show where plant choice occurs between the field and the food chamber.

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