

S. emarginatus and *A. serratus* display characteristic flowering phenology with alternation of staminate and pistillate functions within individual plants contributing to temporal dioecism.

C. canescens and *C. halicacabum* do not exhibit such flowering phenology. The simultaneous presence of staminate and pistillate flowers in *C. canescens* at the plant level facilitates selfing through geitonogamy and the synchronous flowering of plants in an area allows fruit set through xenogamy. Selfing may be a special adaptive value for this herbaceous vine, and compatibility to cross-pollen provides scope for maintaining genetic heterogeneity. The production of more staminate flowers against pistillate flowers is a mechanism for adjusting reproductive effort to male or female functions¹⁴ for increasing male fitness, since the resources saved by producing fewer pistils could be directed to male function¹⁵ and also for meeting the requirement of pollen-collecting bee pollinators. The conspicuous floral display serves as an attractant to pollinators¹⁶.

Despite being white and prominent, the flowers could attract only a few pollinator species. This could be due to the production of nectar in traces. *C. halicacabum* also produces nectar in traces and is pollinated by a few insect pollinators¹⁰. Likewise, *C. integerrimum* has been reported to be exclusively pollinated by three species of bees, *Xylocopa* sp., *Apis mellifera* and *Trigona spinipes*¹⁷. Therefore, the production of traces of nectar appears to be an inherent trait in

Cardiospermum species and adaptive to attract only a few insect pollinators. *C. canescens* is thus entomophilous. The fruit characteristics in *C. canescens* conform to the genus name. The fruit is a tri-lobed capsule with each lobe containing a single seed³. *C. cardiospermum* and *C. microcarpum* also produce fruits with the same characteristics^{10,18}. Seeds of *C. canescens* germinate depending on the soil moisture status. The study suggests that the plant with monoecy, geitonogamy and xenogamy, and with a few insect pollinator species reproduces successfully and builds up sufficient populations in favourable areas, especially in open scrubs.

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Received 14 June 2010; revised accepted 27 July 2011

A. J. SOLOMON RAJU*
K. VENKATA RAMANA
N. GOVINDA RAO
P. VARALAKSHMI

Department of Environmental Sciences,
Andhra University,
Visakhapatnam 530 003, India

*For correspondence.
e-mail: ajsraju@yahoo.com

Cynodon dactylon (L.) Pers.: a self-treatment grass for dogs

Vomiting can be defined as a voluntary or forcible expulsion of the stomach contents through mouth and nostrils^{1–3}. By this, over-loading of the stomach can be easily relieved during normal gastric trouble⁴. Many animals, especially dogs and cats instinctively treat themselves during illness or indigestion. Studies have revealed that vomiting in these animals is a safeguard (not always) against indigestion for food poisoning and other indigestible materials², viz. polythene bag, plastic, strong spices, etc. In Britain, dogs are known to induce vomiting by eating green shoots of *Ely-*

mus hispidus (Opiz.) A. Melderis (*Triticum repens* Hegetschw), indigestion of which stimulates vomiting² in 4–5 min. *E. hispidus*, popularly called dog or cough grass, is a common weed in Europe and America. It is rich in vitamin C and is an anthelmintic, antibacterial, anti-inflammatory, antiseptic, demulcent, diuretic, herbicide, litholytic and sedative⁵. This grass is extensively used in human medical preparations to cure diseases like herbalist of gout, enlarged prostate gland, incipient nephritis, purulent cystitis, jaundice, incontinence urination, restoration of poor eyesight, chest pain,

syphilis, lumbago, irritation of bladder, as a female corrective agent, etc. in Europe, America and Russia⁶. It is interesting that unlike Europe, vomit-inducing grasses in dogs and cats have not been mentioned in the literature related with grasses^{7–12} and medicinal plants^{13–20} of India and the adjoining countries. However, it is a well-known fact that these animals prefer grasses to induce vomiting by regurgitation.

Since last two years one of us (M.K.K.) has been observing dogs for their grass-eating habit. About 25 dogs were observed during this period which included Dober-

man, German Shepherd, Rottweiler, Labrador, Spitz, Pomeranian and some local breeds. These pets eat grass usually when they have, indigestion, liver dysfunction, poisoning or any other gastrointestinal problem to induce (3–5 min in the dogs observed) vomiting. Often self-treatment was found to be an effective naturopathy, but in severe cases of liver dysfunction and poisoning (with insecticides, pesticides or any other poison of same category), it was not much rewarding. In such cases this treatment only delayed the deteriorious effects and for survival the pets also required medical aid. In one case (poisoned with malathion), in spite of self-treatment and delayed medication the dog died due to toxic effects.

Critical observations of pet habit and vomiting (mixture of bile and grass) the grass observed was found to be *Cynodon dactylon* (L.) Pers. (Figure 1 a). Further, the grass parts in the vomitus (the vomiting extract from the stomach) are usually found intact or minutely ruptured, showing that the animals often try to swallow, but never chew it. *C. dactylon*, locally known as dhub or doob, is also a good Ayurvedic medicine. Leaves and culms in some regions have served as famine food and the rhizome is considered to have laxative property²¹. One of the important grass in medical preparation is also used as a substitute for *E. hispidus* (dog grass) in Indian *Materia Medica*¹⁸.

There could be two main factors by which doob induces vomiting in dogs. First, is the scabrid margin of leaf blades with minute bristles (Figure 2). When dogs swallow this grass, the bristles on the margin of the leaf blades, or the leaf blade pieces irritate the inner layer, i.e. mucus membrane and muscles of the oesophagus, pharynx, larynx and stomach, which further causes regurgitation

and brings out the vomitus. This process of regurgitation in dogs due to grass leaves can be explained by the fact that whenever there is a tendency to vomit human beings often try to irritate the oesophagal area by putting two fingers inside the mouth to induce vomiting. Similarly, as mentioned earlier, dogs ingest/eat the leaves of *C. dactylon* to create irritation. Second, dogs (carnivorous) are usually fed on flesh and cooked vegetables. When they swallow raw grass, the internal layers of the digestive tract do not accept it, and comes out as vomitus along with all other materials through regurgitation. The second explanation seems inappropriate and raises a question: when regurgitation can also be done with other grasses or herbs, then why do dogs prefer *C. dactylon*. It might be possible that some unknown chemical(s) extracted from the leaves, on reaching the gut, react with the materials present there and bring out the vomitus. But as previously mentioned the leaf blades are often found intact (not crushed) and there are less chances of chemical release, and thus any reaction. However, this needs further study.

Also, *C. dactylon* is an odourless grass, whereas most plants with bristles or hairs often release/have some kind of chemical/aroma, due to which they may be ignored by the dogs.

During winter when offshoots of this grass and other cereals are mature, fungi like *Ustilago* sp. (Smut, Figures 1 b and 3 a–c) and *Claviceps* sp. (Ergot) parasitize the inflorescence. The intake of infested grass in smaller amounts for a longer period results in diarrhoea, colic, vomiting and abdominal pain in cattle. But when these cattle take infested grass in large amounts it causes gangrene, poisoning and abortion in pregnant animals, which sometimes results in death. Exten-

sive outbreak by the fungi has been reported to occur in different parts of USA, Germany, Austria, Australia and Europe^{2,22}. In India also, such effects have been observed in cattle. It is important to note that dogs never eat the infested *C. dactylon*, as they possess the ability to recognize the infection. How dogs do so is still unknown. Also, how pet dogs that have been grown in isolation, hunt for this grass only during illness is not known. It seems likely that there could be a chemical compound (having mild odour) in the leaves or culms, that is absent in other herbs or grasses, and is peculiarly recognized by the dogs that stimulates them to identify the grass.

It has also been noticed that rarely some dogs eat (not swallow) other grasses like *Zoysia pacifica*, *Digitaria* sp., *Lep-tochloa panicea*, etc., when they are not ill, but for the reasons unknown.

C. dactylon is considered a sacred grass by the Hindus with its earlier descriptions found in *Artharva Veda* as 'May Duba'¹⁷ and in *Rig Veda* as 'Durva'²³. Its vernacular names, important chemical constituents and medicinal properties in brief are provided below for further references.

Cynodon dactylon (Linn.) Pers., Syn. Pl. 1: 85, 1805.

Vernacular name – English: Cough grass, Dog grass; Hindi: Doob, Hariyali, Ramghas; Oriya: Duba; Punjabi: Khabbal, Talla, Duba; Sanskrit: Dhurva, Haritali;



Figure 1. *Cynodon dactylon*. a, Normal uninfected inflorescence. b, Inflorescence infected with *Ustilago* sp.

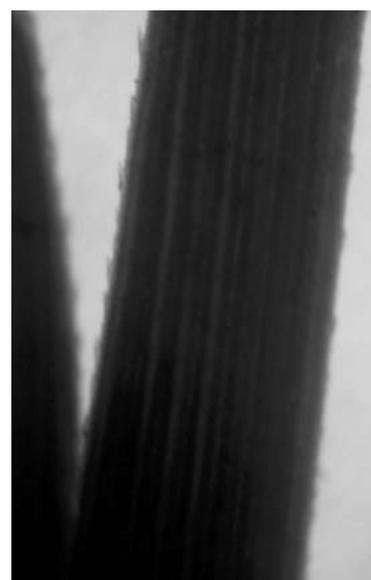


Figure 2. *Cynodon dactylon*, leaf blade with bristles on the margin.

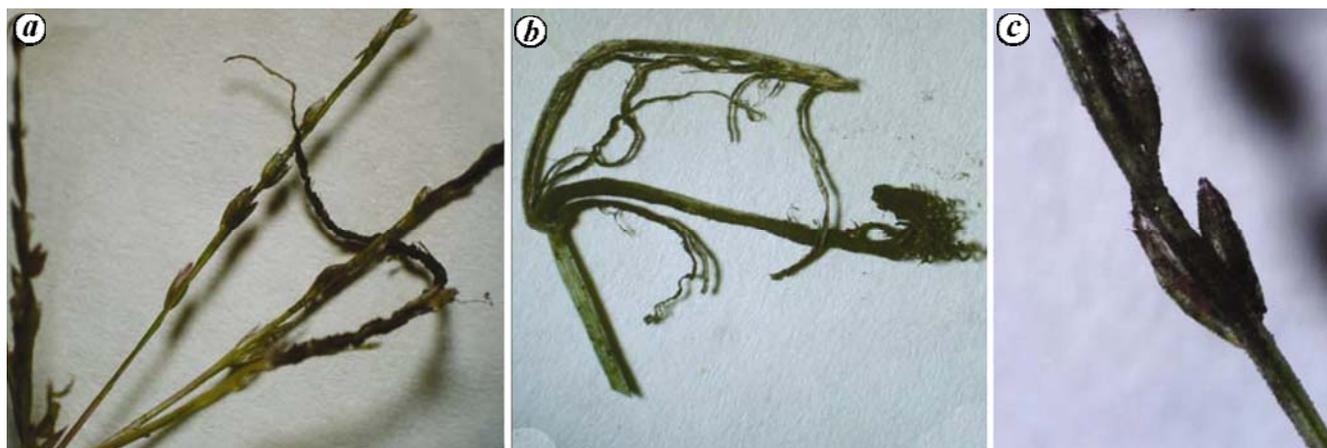


Figure 3. *Cynodon dactylon* enlarged view of infected inflorescence (a, b) and spikelets (c).

Tamil: Arugampulla, Kannada: Kudi-garikal; Telegu: Gericha, Gaddi.

Medicinal properties – The rhizome of this grass is used in urinary problems¹². It is a diuretic and used in case of dropsy and anasarca, and also used in secondary Syphilis. Infusion of roots is useful to stop bleeding from piles^{16,19}. It is a good plant antiepileptic, anti-diarrhoeal, anti-catarthal and inopthalmia. The excreted juice is astringent and can be applied to bleeding cuts and wounds^{14,24}.

Chemical constituents – Six phenolic phytotoxins, ferulic, syringic, *p*-coumaric, vanillic, *p*-hydroxybenzoic and *O*-hydroxyphenyl and acetic acids, are reported from the plant. Leaves contain tricin, flavones, C-glycosides and a flavonoid sulphate²⁴.

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ACKNOWLEDGEMENTS. We thank the Joint Director, Botanical Survey of India (NRC), Dehra Dun for providing facilities. We also thank the Director and Chief Librarian, Indian Council of Forestry Research and Education, Dehra Dun and Wildlife Institute of India (WII), Dehra Dun for providing library facilities. Dr Vandana, DAV (PG) College, Dehra Dun and Manoj Hembarum, BSI (NRC) helped identify the fungal infection. We are grateful to Dr G. S. Rawat, WII, and Dr Prashant Pusalkar and Manas Ranjan Debta, BSI (NRC) for useful suggestions.

Received 22 March 2010; revised accepted 15 July 2011

MANISH K. KANDWAL^{1,*}
M. L. SHARMA²

¹Botanical Survey of India (NRC),
Dehra Dun 248 195, India

²Pet Clinic,
No. 31, Ghari Cantt,
Dehra Dun 248 003, India

*For correspondence.
e-mail: zoysia04@gmail.com