Beetles in ballast

from R.A. Crowson

IN former times, ships commonly sailed from European ports to North America heavily 'in ballast', filling up with cargo for their return trips. Ballast was generally picked up in the form of sand or shingle from conveniently accessible points on the shore, and discharged in the vicinity of American ports, often in or around the St Lawrence estuary. In the process numerous European terrestrial invertebrates were introduced into a new continent, in which many of them became established. Beetles, probably on account of their exceptional adult longevity and endurance are very well represented among these involuntary colonists, and were particularly discussed by C.H. Lindroth in his book *Faunal Connections between Europe and North America* (1957). One species he did not consider is brought to light in an excellent recent revision* of the American species of *Rhyssemus* and *Trichorhyssemus* (Scarabaeidae). The European *Rhyssemus germanus*, apparently first found by the St Lawrence estuary in 1929, is now recorded at several points around the Great Lakes and seems to be spreading. The same species seems to have become at least temporarily established in several other remote parts of the world, no doubt in the same way. As can be seen from the figure, *R. germanus* is not particularly similar to any of the native American species, suggesting that separation of the European and American faunas in this group is fairly old.

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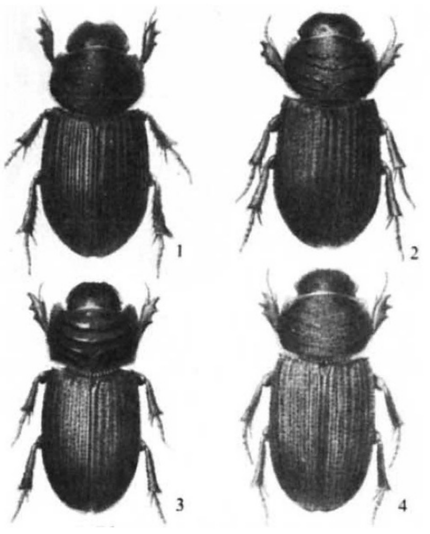

1 *Rhyssemus scaber* Haldeman;
2 *Rhyssemus neglectus* Brown;
3 *Rhyssemus germanus* (L.);
4 *Rhyssemus sonatus* LeConte.

*(Gordon and Cartwright *The Western Hemisphere Species of Rhyssemus* and *Trichorhyssemus*, Smithsonian Contributions to Zoology **317**, Smithsonian Instn Press; 1980).

A bright nearby supernova

from Roger A. Chevalier

SUPERNOVA 1979c was discovered on 19 April 1979 in the galaxy M100 by Johnson (*IAU Circ.* No.3348; 1979). The supernova explosion occurred in a spiral arm of the galaxy implying that it was of Type II — related to the explosions of massive stars. The apparent visual magnitude of the supernova near maximum light was 12, making it the brightest Type II supernova since the supernova 1970g. Observations were made at a variety of wavelengths and have revealed new properties of the Type II supernova emission and enabled a new distance estimate to be made for the Virgo cluster of galaxies.

An initial series of coordinated observations at optical, ultraviolet, X-ray and radio wavelengths was undertaken by an international group of collaborators in the first six weeks after the discovery (Panagia *et al. Mon. Not. R. astr. Soc.* **192**, 861; 1980). The observational facilities included the 5-metre telescope on Mt Palomar, the IUE (International Ultraviolet Explorer) satellite and the VLA (Very Large Array) radio interferometer. The optical properties showed the usual characteristics of a Type II supernova: most of the light was in continuum radiation that could be approximately fitted by a blackbody spectrum with a temperature close to 10,000K. Superposed on the continuum were broad lines of hydrogen and other elements in low stages of ionization. The lines developed P Cygni profiles of emission with blueshifted absorption. If the lines are formed close to the supernova photosphere then the velocity of gas at the photosphere can be deduced from the blueshift of the absorption minimum to be about 8,000 km s^{-1}.

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The IUE observations provided the first UV observations of a Type II supernova. The light was dominated by the continuum radiation, although there was excess emission over the blackbody spectrum at low wavelengths. This may be emission from gas heated in the fast shock wave moving into the material surrounding the exploding star (Branch *et al. Astrophys. J.* in the press). Line features were also observed. Of particular interest were symmetric lines of highly ionized atoms (such as N V, Si IV and C IV) with maximum line widths corresponding to velocities of 4,000 km s^{-1}. The lack of occulting effects in the line profiles implies that the emission was at least two photospheric radii from the centre of the star. Panagia *et al.* suggested that the emission was from a circumstellar shell around the presupernova star which had been accelerated by the supernova radiation.

In the months after maximum, the visual light declined with a time scale of about 20 days. Spectra taken in November 1979 and thereafter showed that the light was dominated by a broad Hα line (Branch *et al.;* Kirshner and Chevalier, in preparation). An energy source is required to ionize the gas to produce the Hα line and two possibilities are γ rays from the radioactive decay of isotopes synthesized in the supernova explosion and high-energy emission from a central pulsar. At later times, the IR emission dominated the optical emission. In January 1980, Merrill (*IAU Circ.* No.3444; 1980) found an IR flux about 60 times the flux in the Hα line. He suggested that dust formation occurred in the supernova material, but the mechanism that maintains the ionization in the expanding envelope probably also maintains the gas temperature above the condensation temperature for dust formation. Another possible source of the IR radiation is emission by dust in a circumstellar shell that is heated by the supernova radiation (Bode and Evans *Mon. Not. R. astr. Soc.* **193**, 21; 1980). This model requires an absorption optical depth through the circumstellar shell that is close to the upper limit on the absorption set by observations of the supernova near maximum light, but the properties of the shell are in accord with the known properties of mass loss from red supergiant stars, which are thought to be the progenitors of Type II supernovae.

Radio observations with the VLA in April 1979 did not yield a detection, but gave an upper limit of 0.3 mJy (1 mJy = 10^{-26} erg cm^{-2} s^{-1} Hz^{-1}). However, the observations were repeated in April 1980 at a wavelength of 6 cm and the supernova was clearly detected at a level 5 mJy (Weiler and Sramek *IAU Circ.* No.3485; 1980). The minimum brightness temperature of the emitting region was several times 10^9K if the size of the region was comparable with the radius of the supernova envelope. This indicates that the

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